BRITISH
MUSEUM
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NATURAL
HISTORY.

PROCEEDINGS
OF THE
Bournemouth Natural Science Society.

VOL. XXII.

SESSION 1929-30.

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BRITISH MUSEUM NATURAL HISTORY

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Introductory Note.

THE Bournemouth Natural Science Society was founded in 1903, being the successor to an older society which was formed in 1883 and dissolved in 1897. The early meetings of the Society were held in a room hired from time to time for the purpose, but the need of some fixed quarters was soon felt. To meet this need a small room was taken at 122 Old Christchurch Road, and, as this proved inadequate, in February, 1909, better accommodation was secured at Granville Chambers and retained for four years. In March, 1913, the Society took on lease from the Education Committee a large room on the ground floor of the Municipal College. In 1919 this also had to be given up, and the Society succeeded in acquiring a house of its own, 39 Christchurch Road. The formal opening was on February 7, 1920. In 1929 a Lecture Hall was added, and the ground floor of the old building reconstructed. The work was completed and the New Hall inaugurated on October 14, 1929.

The objects of the Society are declared by the second of its rules to be " the promotion of the study of Science in all its branches, by means of Lectures, Field Meetings, the Reading and Discussion of Papers, and the formation of Sections of its members devoted to any particular branch of the Society's work, and in any way that the Council of the Society shall deem advisable."

The Sections at present working are as follows:—**Archæological and Historical, Astronomical, Botanical, Entomological, Geographical, Geological, Microscopical, Photographic and Record, Physical, and Zoological.**

During the WINTER SESSION, from October to April, GENERAL and SECTIONAL MEETINGS are held, comprising Lectures and Demonstrations on subjects of scientific interest, illustrated by lantern slides, diagrams, specimens or experiments.

All meetings are open to all members of the Society.

Throughout the SUMMER SESSION, EXCURSIONS to places of interest in the neighbourhood are arranged and indoor or garden meetings occasionally held.

The management of the Society is vested in a Council, which is elected at the Annual General Meeting, held in October.

The Society possesses a Library available for the use of members. This is yearly becoming more extensive and valuable by the acquisition of standard text books and of books dealing with matters of local scientific interest. Books may, under certain conditions, be borrowed by members, and there is a Reading Room in which works of reference may be consulted.

The Society's collections of archæological, botanical, geological, zoological and other specimens are now arranged in the MUSEUM. Articles on the collections were contributed to Vols. V. X. and XVII. of the Proceedings by Sir Daniel Morris, Mr. W. G. Wallace and Rev. C. O. S. Hatton respectively.

Members are elected by the Council and pay an annual subscription of £1 for full membership (admitting to all meetings and excursions for the year), a subscription of £2 covers four adult members of the same family residing in the same house.

A MONTHLY NOTICE, giving full details of all meetings, etc., is posted to every member before the beginning of each month, and a volume of Proceedings is published every year.

Application Forms for Membership, and further particulars. can be obtained from the

HON. SECRETARY,

Bournemouth Natural Science Society.
39 Christchurch Road,
Bournemouth.

Bournemouth Natural Science Society.

OFFICERS AND COUNCIL FOR 1929-1930.

President

PROFESSOR F. O. BOWER, D.Sc., F.R.S.

Vice-Presidents

Henry Backhouse, F.R.H.S.
Henry Bury, M.A., F.L.S., F.G.S.
G. E. J. Crallan, M.A., M.B., M.R.C.S.
Rev. C. O. S. Hatton, B.A., F.L.S.
F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.
R. V. Sherring, F.L.S.
Heywood Sumner, F.S.A.
Claude Lyon
Sir Daniel Morris, K.C.M.G., J.P., M.A., D.SC., D.C.L., LL.D., F.L.S.

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Rev. C. O. S. Hatton, B.A., F.L.S.

Deputy-Chairman of Council

F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.

Council

The Officers and Chairmen of Sections (ex-officio)

Henry Backhouse, F.R.H.S.
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Miss C. H. Fryer
J. B. Hurry, M.A., M.D.
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Miss S. G. Rooke
J. H. Scott, M.E., M.I.M.C.E.
J. H. Ralph Smythe, J.P.
J. F. Spencer
W. J. Woodhouse, A.C.P.

Chairmen of Sections

Archæological and Historical : R. K. Cardew, B.A.
Astronomical : J. A. Formoy, F.R.A.S.
Botanical : L. Beeching Hall, F.L.S.
Entomological : Alan Druitt, F.E.S.
Geographical : Claude Lyon.
Geological : Henry Bury, M.A., F.L.S., F.G.S.
Microscopical : F. B. Taylor, B.A.
Photographical and Record : W. Dieselhorst, A.M.I.C.E.
Physical : Miss Marcia Penrose, B.SC.
Zoological : F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.

Hon. Treasurer

G. Brumell, A.R.I.B.A., Maori, 15 Richmond Park Avenue.

Secretaries

Hon. Secretary : Rev. A. G. Yates, M.A., R.N., 14 Wellington Road.
to whom all official correspondence should be addressed.

Hon. Assistant Secretary : W. J. Woodhouse, A.C.P., M.I.H., 35 Chatsworth Road.

Assistant Secretary : J. F. Spencer, Glenthorne, Richmond Park Road.

Hon. Librarian

CLAUDE LYON, Shalimar, Wilderton Road.

Hon. Editor

J. R. WHITE, M.A., Whitecot, Linwood Road.

Hon. Curator

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Hon. Auditors

E. BICKER & SON. F. BROAD.

Bankers

NATIONAL PROVINCIAL BANK OF ENGLAND, BOURNEMOUTH.

List of Members.

Revised to 3rd November, 1930.

* Honorary Members. † Past Presidents.
o Original Members.
G Morris Gold Medallist. A Associate Members.
The year of election is given before the name of each member.

A

1928	Abernethy, Mrs.	4 Branksome Gate, Branksome Park
1928	A Adcock, Miss M. D., B.SC.	Newbold Verdun, Orchard Avenue, Parkstone
1927	Adkins, H.	Glenavon, 107 Alumhurst Road
1924	Amos, Miss E.	Langley Dene, 55 Wellington Road
1920	Anderson, Col. E. B., C.B.E.	Woodmanton, 35 Wellington Road
1922	Anderson, Col. R. F.	Glenalmond, 5 Madeira Road
1923	Anderson, Mrs.	,, ,, ,,
1923	Anderson, Mrs. M.	Ranfurly, 18 Dean Park Road
1914	Andrews, W.	Brownlea, Berkeley Road
1911	Atkins, Mrs.	10 Fortescue Road
1924	Attwell, A. F., M.P.S.	17 Hamilton Road
1926	Audain, Mrs. N. M.	1 Durrant Villas, Avenue Road

B

1906	Backhouse, H., F.R.H.S.	Hill House, 10 Parsonage Road
1929	Baker, H. J., F.I.A.	Clifton, Sandbourne Road
1929	Balfour, Col. J. H.	The Brown House, Ferndown
1928	Ball, Miss J. E.	Restawhile, Whitecliff Road, Parkstone
1930	Banks, R. McLachlan, M.B., C.M., D.P.H.	Carisbrooke, Tregonwell Road
1929	Barker, H.	Mossgiel, King's Avenue, Parkstone
1922	Barker, S.	66 West Cliff Road
1921	Barker, Miss W.	,, ,,
1905	Barlow, E. W., B.SC., F.R.A.S., F.R. MET. S.	Greengates, Wadhurst, Sussex
1912	A Barraclough, A., M.A., F.R.G.S.	173 Richmond Park Road
1909	Barratt, J. Hayes	Brundon, 2 Surrey Road
1924	Barratt, Mrs.	,, ,,
1924	Barratt, Miss P. M.	,, ,,
1930	Barroll, Mrs.	4 Exeter Mansions, Exeter Park Road
1905	Bartlett, H. F. D., F.E.S.	Island of St. Helena, South Atlantic
1920	Bartlett, P. R.	35 King's Park Road
1930	Barton, C. P.	11 Beechey Road
1930	Barton, Mrs.	,, ,,
1927	Bater, G. W., B.A.	22 Dingle Road
1927	Bater, Mrs.	,, ,,
1927	Bater, Miss K. J.	,, ,,
1928	Beale, J. Bennett	Sunnycourt, Glenferness Avenue
1918	Beale, Mrs.	,, ,,
1928	Beale, Miss E. E.	,, ,,
1929	A Beer, Miss G. A.	Marchwood, Princess Road
1923	Benest, Mrs. A. S.	Tijuca, 54 Wellington Road

1904	Bennett, H. Morden	Sweet Briar, 12 Derby Road
1920	Bennett, Risdon, M.A.	Yew Tree Cottage, Broadstone
1921	Bevan, Trevor	17 Stirling Road
1930	Bird, Miss E.	Canford, Cliff Drive, Canford Cliffs
1923	Bishop, E.	21 Surrey Road
1912	Blackall, Miss E. E.	10 Harcourt Road, Boscombe Park
1910	*Bond, F. Bligh, F.R.I.B.A.	454 Gloucester Road, Bristol
1920	Borrett, Surgeon-Capt. G. G., R.N.	62 Alum Chine Road
1924	Borrett, Mrs.	,, ,,
1925	Borrow, Frederick	The Knoll, Charminster Road
1925	Borrow, Mrs.	,, ,,
1924	Bottomley, Miss O.	Langley Dene, 55 Wellington Road
1929	Bourdass, Miss A.	7 Beaulieu Road
1929	Bourdass, Miss F.	,, ,,
1920	ABourne, Miss C. M.	56 Sunny Hill Road, West Southbourne
1930†	*Bower, Prof. F. O., D.SC., F.R.S.	2 The Crescent, Ripon
1927	Boyt, Miss J.	1 Ascham Road
1914	Bradbury, Miss E.	La Bocca, 2 Portarlington Road
1925	Bradley, F. L.	Holmwood, 12 Chine Crescent Road
1922	Brewitt-Taylor, Mrs. Ray	10 Forest Road, Branksome Park
1926	Broad, F.	Manton Villa, 2 Oxford Road
1928	Broad, Mrs.	,, ,,
1921	Bromley, Miss	81 Lansdowne Road
1917	Brown, Edward	West Ridge, Chessel Avenue
1917	Brown, Mrs.	,, ,,
1924	Brown, Miss F.	Chobham House, 4 St. Winifred's Road
1926	Brown, Lt.-Col. F. Tatton	Talbot Hurst, 3 Glenferness Avenue
1929	Brown, Miss H. E.	87 Wentworth Avenue
1923	Browne, John	Serantes, Glen Road, Boscombe
1924	Browning, Miss E. M.	Littleholm, Ferndown
1905	Brumell, G., A.R.I.B.A.	Maori, 15 Richmond Park Avenue
1920	Brumell, Mrs.	,, ,, ,,
1929	Brumell, Miss H. M.	,, ,, ,,
1920	Brumell, Miss M.	,, ,, ,,
1920	Bryant, Miss M.	Sunnyhill, Hampden Lane, W. Southbourne
1929	Buckingham, H.	6 Bodorgan Road
1907	Bulfin, Ignatius, B.A.	The Den, 26 Knole Road
1908	Bulfin, Mrs.	,, ,,
1929	Bunce, Miss A. M.	Rowan Tree House, Alum Chine Road
1930	Bunce, Miss F. E.	,, ,, ,,
1929	Burge, J. T.	Glenhurst, Braeside Road, West Moors
1924	Burgess, J.	Kempston, Chine Crescent Road
1927	Burrell, Mrs. A. E.	Freydan Lodge, Poole Road
1924	Burroughs, F. G.	63 Maxwell Road
1919	Burstal, E., M.D.	46 Lansdowne Road
1926	Burstal, E. K., M.I.C.E.	27a Grove Road
1926	Burstal, Mrs.	,, ,,
1922	Burton, E. St. John, F.L.S., F.G.S., F.Z.S.	Melville, 4 Howard Road
1927	Burton, Stewart	Dunmere, 17 Eaton Road
1922	Bury, Henry, M.A., F.L.S., F.G.S.	The Gate House, 17 Alumdale Road
1930	Bury, Mrs.	,, ,, ,,
1930	Bury, Miss G. E.	,, ,, ,,
1930	Bury, Miss G. I.	,, ,, ,,
1930	Butler, G. W.	Seacombe, 54 Wimborne Road, Poole

C

1928	Calkin, J. B., M.A.	Wychwood School
1924	Campbell, Mrs.	Whingate, Broadstone
1919	Cardew, R. K., B.A.	Stafford Lodge, 26 Dean Park Road
1920	Cardew, Mrs.	,, ,, ,,
1929	Carle, J.	Jedburgh, 39 Namu Road, Winton
1912	Carus-Wilson, C., J.P., F.R.S. (Edin.), F.G.S.	Altmore, Waldegrave Park, Strawberry Hill, Middlesex.
1930	Chadwick, Mrs. E.	Oriana, Burton Road
1930	Chandler, Mrs. Whitty	St. George's, Cecil Road, Boscombe
1925	Chilver, Mrs. E. K.	2 Shaftesbury Road
1912	aChilver, Miss K. M.	,, ,,
1927	Christy, R. W.	Greyfriars, Ringwood
1926	Clare, Mrs.	48 Queen's Park West Drive
1929	Clarke, Mrs. T.	26 Bodorgan Road
1929	Clarke, Mrs. V. M.	16 Woodland Avenue
1927	*Clay, R. C. C., M.D., F.S.A.	The Manor House, Fovant, Wilts
1908	Coddington, E. F.	34 Irving Road
1929	Colledge, T.	3 Watkin Road, Boscombe
1929	Collen, Miss J.	10 Grove Road
1928	Connah, J., B.SC., F.I.C.	Deva Cottage, Braidley Glen
1928	Constantine, M. H.	Brendon, Nairn Road
1929	Cooke, A. C., O.B.E.	19a Knyveton Road
1929	Cooke, Miss I. D.	,, ,,
1912	Cooper, Ernest	100 Old Christchurch Road
1926	Cooper, H. A.	25 Talbot Avenue
1926	Cooper, Mrs.	,, ,,
1926	Cooper, A. H.	,, ,,
1926	Cooper, Miss S. I.	,, ,,
1926	Cooper, J. S.	The Little Red House, Colehill, Wimborne
1930	Cooper, Miss Marion	Lymers Ley, Byron Road, Boscombe
1930	Cornish, Miss M. E.	35a Richmond Wood Road
1903	†oCrallan, G. E. J., M.A., M.B., M.R.C.S.	St. Cross, 13 Bodorgan Road
1922	Crallan, Mrs.	,, ,,
1920	Cressy, Miss H.	Bramcote, 1 Glen Road, Boscombe
1922	Crowther, Miss V.	Berwyn Bank, Poulner Hill, Ringwood
1922	Curme, Miss M. E.	65 Lansdowne Road
1930	Curry, Denis	Lynton, Alyth Road
1928	Curtis, E. A., L.D.S.	Holm Dene, Poole Road
1928	Curtis, Mrs.	,, ,,
1928	Curtis, E. J. B., L.D.S.	,, ,,
1903	oCurtis, W. Parkinson, F.E.S.	Drake North, Sandringham Road, Parkstone
1922	*Elected an Honorary member	

D

1927	Dacombe, J. M. J.	Gosfield Cottage, Winkton, Christchurch
1920	Darke, Miss W. E.	25 Hawkwood Road, Boscombe
1921	aDavies, Miss H. V., B.SC.	Municipal College
1919	Davison, Miss L.	15 Dean Park Road
1930	Dawes, Miss E. M.	85 Fitzharris Avenue
1929	Dawson, Miss L. N.	20 Carbery Avenue
1924	Deas, J., M.A., I.C.S.	57 Wellington Road
1930	de Castro, H.	Seldown House, Poole
1926	de Paiva, Miss E.	Sunny Halt, Hamilton Road, Boscombe
1914	Dickson, Col. W. D., J.P.	Southill, 32 Dean Park Road
1914	Dickson, Mrs.	,, ,,

1924	Dieselhorst, Mrs.	50 Surrey Road
1903o*	Dixon, J. R. L., M.R.C.S., L.R.C.P.	
1928	Dodds, H.	19 Foxholes Road, Southbourne
1910	Dodshon, E., LL.B.	126 Old Christchurch Road
1926	Dodwell, Mrs. L. B.	Crendon, Carbery Avenue, West Southbourne
1930	Doncaster, E. D.	Byways, Burley, Ringwood
1930	Doncaster, Mrs.	,, ,,
1930	Doncaster, Miss K. M.	,, ,,
1930	Dowdeswell, D.	Hazelwood Hotel, St. Peter's Road
1928	Drew, Lt.-Col. C. D., D.S.O., F.S.A.	Dudsbury House, Longham, Wimborne
1929	Drew, R. C.	66 Wimborne Road
1929	Drew, Mrs. C. M.	,, ,,
1929	Drew, R. E. I.	,, ,,
1923	Druitt, Alan, F.E.S.	Willow Lodge, Mudeford, Christchurch
1923	Druitt, Mrs.	,, ,, ,, ,,
1925	Druitt, Miss C. M.	99 Lowther Road
1925	Druitt, Miss C. S.	,, ,,
1928	Dundee, Col. W. J., C.I.E., R.E., F.R.G.S.	38 Portchester Road
1926	Dundee, Mrs.	,, ,,
1929	Dunn, Spencer S., M.B., J.P.	58 Portchester Road
1921	Dunn-Gardner, R. C.	24 Queensberry Place, S. Kensington, S.W.7
1929	Dunphy, V.	9 Manor Road

E

1924	Edwards, Miss M. J.	Aysgarth, 16 Poole Road
1929	Eldridge, Mrs. H.	L'Incontro, 9 Penn Hill Avenue, Parkstone
1923	Ellen, Miss D. M.	Staunton, Exeter Park
1922	Ellis, Mrs.	10 Forest Road, Branksome Park
1922	Ellis. Miss W. M.	,, ,, ,,
1923	Elrington, R.	Mavis Bank, 15 Bodorgan Road
1923	Elrington, Mrs.	,, ,,
1922	Elwes, Mrs.	Corner House, Little Forest Road
1924	Ensor, Mrs.	26 Frederica Road, Winton
1929	Evans, C. I., M.A.	Boundway Top, Sway, Lymington
1909	Evans, P. H. L., M.A.	Stirling House, 28 Manor Road
1927	Exon, C., M.A.	Aldermoor, Douglas Road, Southbourne

F

1920	Fairbrother, Miss L.	4 Golf Bungalows, Hindhead, Surrey
1921	Fane, F. L.	Haldon, Spur Hill Avenue, Parkstone
1921	Farmar, Miss D. A.	Dorset Lodge, 10 Suffolk Road
1919	Farmar, Mrs. K. A.	Whitton Lodge, Stevenson Crescent, Parkstone
1922	Farmar, Miss E. A.	,, ,, ,, ,,
1929	Fell, Mrs. Henry	9 Branksome Wood Road
1914	Fielding, T., M.D.	Genesta, West Hill Road
1927	Finlinson, F. J.	Daneshill, Queen's Park Avenue
1927	Finlinson, Miss D. C.	,, ,, ,,
1903oA	Firbank, Miss, LL.A., A.C.P.	5 Buchanan Avenue
1922	Fonblanque, Miss Ida	4 Gordon Road
1929	Forbes, A. G.	51 Ophir Road

1928	Formoy, J. A., F.R.A.S., F.C.S.	The Grove, Grove Road
1917	Forrest, Mrs.	Hip Roof, Benellen Road
1925	Fountain, E. D., L.R.C.P., M.R.C.S.	Vron, 30 Mansfield Road, Parkstone
1925	Fountain, Mrs.	,, ,, ,, ,,
1922	Fowler, A. R. W., B.A.	St. Ina, Beechwood Avenue
1922	Fowler, Mrs.	,, ,, ,,
1919	Fowler, Miss M. L.	Lerryn, Chessel Avenue
1924	Freer, Miss L. W.	1 Branksome Park Avenue
1927	French, F. W.	1 Ascham Road
1927	French, Miss J. E.	,, ,,
1909	French, J. M.	Jumpers House, Christchurch
1923	Fryer, Miss C. H.	Moulton, 46 Wellington Road
1928	Fryer, Miss G. M.	4 Milton Road
1928	Fulcher, L. W., B.SC.	60 Herberton Road
1928	Fulcher, Mrs.	,, ,,

G

1929	Gallaher, Miss M.	60 Surrey Road
1922	Gardiner, Miss F. M.	3 Adeline Road, Boscombe
1926	Gardiner, H. L.	,, ,,
1922	Gatty, Lady K.	Ossemsley Manor, Christchurch
1922	Gatty, Miss H.	,, ,,
1922	Gatty, Oliver	,, ,,
1922	Gatty, Richard	,, ,,
1924	George, Miss M.	3 Balmoral, West Hill Road
1923	Gibbs, F. L. A.	Hawthorns Hotel, West Cliff Road
1921	Gibbs, G. F.	Fairview, 13 Herbert Road
1925	Gill, Miss Ida	Rosslyn, Seldown, Poole
1922	Gill, Major W. R.	Chewton Lodge, Highcliffe
1923	Gill, Mrs.	,, ,, ,,
1924	Goddard, Rev. C. V.	62 Parkwood Road, Boscombe
1925	Goodacre, Rev. C. B.	3 Cecil Road, Boscombe
1929	Goodacre, W., F.R.A.S.	Waratah, Leicester Road
1924	Goode, Mrs.	50 Surrey Road
1927	Gorton, B., M.R.C.V.S., M.P.S.	22 Arnewood Road
1921	Gosse, W., M.D., D.P.H.	Langley, Rowlands, Wimborne
1929	Graves, Basil, M.C., M.A., M.R.C.S., L.R.C.P.	13 Wimborne Road
1929	Graves, Mrs.	,, ,,
1904	Gray, Arthur	Woodville, 26 Melville Road, Winton
1929	Gray, Maj-Gen., W. du G., C.B., J.P., F.R.A.S., F.R.Met.Soc.	Durley Dene Hydro
1914	Greves, E. Hyla, M.D., F.R.C.P.	Rodney House, 19 Poole Road
1917	Grindley, Miss E. J.	Milnthorpe, Rossmore Avenue, Parkstone
1929	Gurney, Miss A.	20 Carbery Avenue

H

1929	Haines, G. E.	602 Christchurch Road
1930	Haines, H. H., C.I.E., F.L.S.	Glen Ashton, Wimborne
1924	Hall, L. Beeching, F.L.S.	Lingdene, King's Avenue, Parkstone
1929	Hall, R. Radclyffe	31 R. L. Stevenson Avenue
1929	Hall, Mrs.	,, ,,
1929	Hallowes, G. P. B., F.R.A.S.	The Sheiling, Colehill, Wimborne
1930	Hardwick, Miss R.	51 Poole Hill

1913	Harris, Miss K.	Trescott Grange, Harvey Road, Boscombe
1912	Harrison, Henry	Eden Lodge, 7 Surrey Road South
1926	Harrison, Miss M. P.	Hinton Vicarage, Christchurch
1929	Harrison, Miss N. B.	64 Parkwood Road
1914	Hartley, Dr. J.	62 Portchester Road
1914	Hartley, Mrs.	,, ,,
1922	Hartley, J. A.	,, ,,
1927	Hartree, D. G.	197 Holdenhurst Road
1914	Hatton, Rev. C. O. S., B.A., F.L.S.	Hinton Vicarage, Christchurch
1921	*Elected an Honorary Member	
1920	Hawes, Miss	The Moorings, 27 Nelson Road
1924	Hawley, Miss H. M.	Galloway Lodge, 27 Florence Road, Boscombe
1917	Haydon, C. J.	Ben Veula, 29 West Cliff Road
1923	Hayman, Mrs.	Thorncliffe, Queen's Park South Drive
1918	Haythorne, E. C. C.	Forest Lodge, Burton Road, Branksome Park
1930	Heigham, Norman	14 Talbot Avenue
1921	Hellyar, Miss E. F.	Cerne Abbas, 1 Belvedere Road
1921	Hellyar, Miss M. F.	,, ,,
1923	Hellyar, Miss M. R.	,, ,,
1917	Henderson, Miss A. J.	Springbank, 22 Fox Road, Greenock
1927	Henderson, F. W., L.R.C.S.I.,	Two Oaks, Bosley Way, Christchurch
1928	Henderson, Major H. E.	Tall Trees, Wayside Road, Southbourne
1928	Henderson, R. G., M.A., M.B., Ch.B. (Aber.), F.R.C.S. (Edin.)	87a Southbourne Road
1930	Heynen, R. H.	32 East Overcliff Drive
1923	Hill, C. S.	Northfield, Chigwell Road
1930	Hilton-Johnson, Miss C.	12 Oban Road
1924	Hoare, Miss E.	Sea Gate, Cassel Avenue
1922	Holdom, Mrs. E.	Cranfield, Mansfield Road, Parkstone
1909	Holmes, Mrs.	Brackenwood, 37 Southern Road, West Southbourne
1911	Holmes, Miss S. C. M.	c/o National Provincial Bank, Southbourne Grove
1911	Homer, L. V. C.	1 Carlton Road
1929	Hooper, Miss M. N.	Southland, Corfe Castle
1928	Horne, Rev. E. H., M.A.	64 Alum Chine Road
1929	Houghton, Miss J.	20 St. Anthony's Road
1930	How, Miss E. A.	71 Victoria Park Road, Winton
1928	Howard, A. F.	Hawthorns Hotel, West Cliff
1924	Howell, W. Rees	Cintra, 35a Richmond Wood Road
1923	Howell, Mrs. Rees	,, ,, ,,
1911	Hudson, F.	Penarol, Parkstone
1911	Hudson, Mrs.	,, ,,
1925	Humby, H. G.	Brackendene, 23 Wimborne Road
1929	Humphrys, Dr. C. B.	29 Wellington Road
1929	Humphrys, Mrs.	,, ,,
1927	Hunt, Mrs. F.	33 Stirling Road
1926	Hurry, Mrs. G. L.	Hinton Firs, 9 Manor Road
1926	Hurry, A. G., M.A.	,, ,, ,,
1930	Hurt, Miss C. E. C. J.	Ingleby Cottage, Wimborne Road

I

1905	Ibbett, F. W., M.A.	Town Hall
1920	*Elected an Honorary Member	
1927	Ingram, Miss S. I. C., B.SC.	Caldicott, Anthony's Avenue, Parkstone
1926	Innes, A. A.	Old Pines, Ferndown

1925	Insch, J. M.	18 Beechwood Avenue
1925	Insch, Mrs.	,, ,,
1930	Insch, Miss E.	,, ,,
1930	Insch, Miss S.	,, ,,

1926	Jackson, Mrs. C. M.	The Dakota, Beaulieu Road, Alum Chine
1921	Jackson, Mrs. Gidlow	64 Portchester Road
1927	Jameson, W. G.	87 Wentworth Avenue, W. Southbourne
1930	Jefferys, J. H.	Elpis, Caledon Road, Parkstone
1923	Jenkins, Miss B. M.	7 Talbot Avenue
1930	Jones, Miss A. Parnell	Menstone, Frankland Crescent, Parkstone
1922	Jones, J. Williamson	Tyndale Lodge, Forest Road, Branksome Park
1908 A	Jones, W.	3 Granville Road, Boscombe
1930	Jones, Mrs. W.	1 Park Road
1927	Jourdain, Rev. F. C. R., M.A., M.B.O.U.	4 Belle Vue Road, Southbourne
1930	Jubb, Miss O.	12 Oban Road

K

1910	Kay, A. J.	Valliscourt, 100 Lowther Road
1930†*	Keeble, Sir F. W., K.B.E., D.SC., F.R.S.	Hammels, Boars Hill, Oxford
1929	Kendall, Mrs.	20 Serpentine Road, Poole
1928	Kendall, Miss G. J., A.R.C.M.	,, ,,
1927	Kilburn, Miss Alice M.	9 Glenmoor Road, Winton
1927	Kilburn, Miss Annie	,, ,,
1928	King, F. G.	66 St. Alban's Avenue
1929	Kirkaldy, D.	Grange, Spur Hill Avenue, Parkstone
1929	Kirkaldy, Mrs. A.	,, ,, ,,
1929	Kirkaldy, Miss J.	,, ,, ,,
1929	Kitchin, E. H., M.A., M.B.	Haldon, Canford Cliffs

L

1928	Lane, F. E.	41 St. Alban's Avenue
1930	Lattey, W. F.	10 Owls Road, Boscombe
1930	Lattey, Mrs.	,, ,,
1930	Laughlin, Col. C.	Carbery Wood, Tuckton Road, Southbourne
1923	Lawrence, Mrs.	66 Portchester Road
1929	Lawson, Miss E.	41 Fortescue Road
1929	Lawson, Miss M.	,, ,,
1929 A	Lee, Miss L., LL.A., F.R.G.S., F.A.G.S.	69 Walpole Road
1930	Lefroy, Mrs.	Campbell House, Campbell Road, Boscombe
1910	Lendrum, Miss A. M.	13 Carysfort Road
1930	Lewis, Miss G.	Wootton Heath Cottage, New Milton
1925	Little, J. T., M.A.	Yed Hill, Ringwood
1925	Little, Mrs.	,, ,,
1925	Little, Miss C. J.	,, ,,
1925	Little, Miss S. P., M.A.	,, ,,
1922	Littleboy, Miss E. S.	2 Bodorgan Manor, 12 Bodorgan Road

1923	Littlewood, Engineer Capt. A. W., R.N., retd., O.B.E., Chevalier Legion of Honour.	28 Princess Road
1922	Logan, T. T.	10 Argyll Road, Boscombe
1916	Logan, Mrs.	,, ,,
1922	Logan, Miss G. M.	,, ,,
1922	Logan, Miss S. M.	,, ,,
1930	Long, E. E., C.B.E.	6 Chine Crescent Road
1924	Longbottom, F. W., F.R.A.S.	Haslemere, Penrith Road, Boscombe
1928	Longbottom, Mrs.	,, ,, ,,
1920	ALove, W. J. E.	St. Clement's School House
1903	oLupton, Miss	2 Hengist Road
1909	†Lyon, Claude	Shalimar, Wilderton Road, Branksome Park
1910	Lyon, Mrs.	,, ,, ,,

M

1908	AMackay, Miss	8 King's Park Road
1929	Mackay, Miss C. J.	,, ,,
1911	McBean, Miss J.	Inglenook, 29 Parkwood Road
1909	McBean, Miss S.	St. Michael's, Buxton
1930	McKenzie, Landseer	St. Bernard, Branksome Wood Road
1930	McKenzie, Miss J. N. Landseer	,, ,, ,,
1930	McKenzie, Miss M. J. Landseer	,, ,, ,,
1930	Macvean, Mrs. C. M.	Woodcroft, Gervis Road East
1920	Male, H. C., M.D., M.R.C.S.	35 Irving Road, West Southbourne
1925	Male, Miss G. E.	,, ,, ,,
1930	†*Malmesbury, The Rt. Hon. the Earl of	Heron Court, Christchurch
1929	Marchant, Rev. Sir James, K.B.E.	Pine Garth, Buccleuch Road
1917	Marston, Miss G.	Bourne Hall Hotel
1913	Martin, Miss F. G.	32 Southbourne Road
1914	Mate, S. J.	10 Landseer Road
1921	Mate, Mrs.	,, ,,
1918	Matthews, Mrs. J. P.	The Bungalow, Lascelles Road, Boscombe
1921	Mattocks, Mrs.	Meyrick Cliffs Hotel, Beacon Road
1925	Mattocks, C. G. B.	,, ,, ,,
1922	Mattocks, T. E. T.	,, ,, ,,
1928	Maunder, A. V., B.A.	Hinton Firs, 15 Gervis Road
1930	Medwin, Miss G. L.	17 Ophir Road
1929	Meyrick, Sir George, BART.	Hinton Admiral, Christchurch
1930	Middle, Miss A. M.	East Cliff Hall
1926	Miles, Mrs. F. A.	Milestone, 16 Meyrick Park Crescent
1930	Miller, Dr. A. H.	Branksea Tower, Parkstone
1925	Miller, Miss B.	Sunnycroft, 15 Penrith Road, Boscombe
1926	Miller, Miss W. F., B.A.	,, ,, ,,
1930	Molineux, A. W.	Wendover, Manor Road, New Milton
1922	Moore, Major T. C., I.M.S.	Verwood, Dorset
1908	†*Morris, Sir Daniel, K.C.M.G., J.P., M.A., D.SC., D.C.L., LL.D., F.L.S.	Sunnyvale, Hawkwood Road
1911	Morris, Lady	,, ,,
1908	Moss, Miss	The Grange, 52 Westby Road
1929	Mott, Lady	4 Dingle Road
1924	Moulson, Miss R.	20 St. Stephen's Road
1928	Muspratt, Brig.-Genl. F. C., C.B., C.M.G.	44 Lansdowne Road

N

1919	Nankivell, B. W. M.R.C.S., L.R.C.P.	Woodstock, 2 West Cliff Road
1925	Newman, Mrs. C. A.	Harewood, 17 Dean Park Road
1928	ANicholls, Miss A. G.	Sainte Marie, Ashton Road, Redhill Park

O

1929	Ogden, Miss E.	Southland, Corfe Castle
1910	Oke, A. W., B.A., LL.M., F.G.S., F.S.A.	32 Denmark Villas, Hove, Brighton
1927	Oldham, H.	Holmesdale, 44 Browning Avenue
1920	Osborne, J. H.	Woodside, Kinson
1922	Ousby-Trew, Miss	Overthorpe, 19 Florence Road, Boscombe
1929	Owen, H., B.A., M.B., M.R.C.S.	59 Manor Road
1929	Owen, Mrs.	,, ,,
1929	Owen, J. D.	81 St. Luke's Road
1929	Owen, Miss E. D.	,, ,,
1929	Owen, Miss M. D.	,, ,,

P

1904	Painter, Mrs.	29 Talbot Road
1919	Parker, Miss M.	The Cliff, 13 Southwood Avenue, W. Southbourne
1926	Parrott, F. W.	33 Heathwood Road
1928	Parry, Miss A. K.	Tilneyhirne, St. John's Road, Boscombe
1926	Parton, Miss E. C.	197 Holdenhurst Road
1926	Parton, Miss M. A.	,, ,,
1927	Paterson, Mrs. E. B.	The Grove, Grove Road
1926	Paterson, Miss L.	Corfe Lodge, Parkstone
1926	Paterson, Miss M.	,, ,,
1926	Paterson, Miss N.	,, ,,
1924	Pattinson, Dr. T. W.	59 Wellington Road
1924	Pattinson, Mrs.	,, ,,
1924	Pells, J.	9 Stokewood Road
1913	†Penrose, F. G., M.D., F.R.C.P., F.Z.S., M.B.O.U.	Woodbury, 9 Grove Road, East Cliff
1916	Penrose, Mrs.	,, ,, ,,
1916	Penrose, Miss F.	,, ,, ,,
1916	Penrose, Miss M., B.SC.	,, ,, ,,
1912	Pestell, Miss	Engelberg, 92 Surrey Road
1930	APeter, A. J.	34 Avon Road
1929	Phelps, Mrs. J. V.	Woodbury, East Avenue
1921	Phillips, Rev. C. A.	36 Dean Park Road
1921	Phillips, Miss C. E.	,, ,,
1928	Phillips, Rev. F. B.	Charlton Marshall, Blandford
1928	Phillips, Mrs.	,, ,,
1920	Pilkington, Miss L. D.	The Steyne, 9 Manor Road
1927	APocock, Miss E.	67 Wentworth Avenue
1921	Pontifex, R. D.	Dalton House, 68 Christchurch Road
1920	Pontifex, Mrs.	,, ,, ,,
1921	Pontifex, G. K. D.	,, ,, ,,
1926	Potter, Rev. Prof. M. C., M.A., D.SC., F.L.S.	Corley Croft, York Avenue, New Milton
1930	Potter, Miss R. M.	26 Avenue Road, London, N.6
1926	Power, Lady	Newlands Manor, Lymington

1930	†*Prain, Lt.-Col. Sir David, C.M.G., C.I.E., F.R.S.	The Well Farm, Warlingham, Surrey
1925	Price, L.	Oakwood, Harvey Road, Boscombe
1925	Price, Mrs.	,, ,, ,,
1925	Price, Miss H. B. K.	,, ,, ,,
1918	Punch, Cyril	60 Wellington Road

Q

1922	Quick, R., F.S.A. (Scot.)	Russell-Cotes Art Gallery and Museum
1924	Quick, Mrs.	,, ,, ,, ,,
1930	Quick, Miss L.	,, ,, ,, ,,

R

1927	Raine, A. D.	Milverton, Lymington
1927	Raine, Mrs.	,, ,,
1928	Randolph, Miss K.	Island View, Parkstone
1912	Rankin, W. Munn, M.SC. (Leeds), B.SC. (Lond.)	Municipal College, Burnley, Lancs.
1920	*Elected an Honorary Member	
1917	Ranshaw, Miss E. M.	9 Warren Road
1918	Ratcliffe, Mrs.	Brooklands, 32 Branksome Wood Road
1930	Ravenhill, Miss M. F.	Eastry Court, Meyrick Road
1926	Rayner, Miss E.	Camelot, Watkin Road
1919	Rayner, Miss F.	,, ,, ,,
1905	*Rayner, J. F., F.R.H.S., M.B. MYC. S.	Swaythling, Southampton
1928	Rees, Miss C. St. B. M.	Invermay, Manor Road, Swanage
1927	Rees, Commandant S. J., J.P.	Branksome Lodge, Avenue Road
1930	Reeves, Rev. R. F.	Ilex, Manor Road, New Milton
1924	*Reid, Mrs. E. M., B.SC., F.L.S.	Pinewood, Milford-on-Sea
1928	Reid, Mrs. F. K.	Westminster Hall Hotel, West Cliff
1928	Reid, Miss F. A.	,, ,, ,,
1919	Richards, Miss E. E., B.SC.	West Cliff Towers, 12 Priory Road
1928	Richards, Mrs. E. M.	17 Dunbar Road
1927	Richey, H. A., B.A.	1 Brookside, Exeter Lane
1927	Richey, Mrs.	,, ,,
1926	Rix, Miss M. E. de B.	Wayside, Stourcliffe Avenue
1916	Roberts, H. Astley, B.A.	Shalvah, Wilfred Road, Boscombe
1918	Roberts, Mrs.	,, ,, ,,
1924	Roberts, Mrs. J.	Aysgarth, 16 Poole Road
1924	Robertson, W. G. A., M.D., D.SC., F.R.C.P., F.R.S. (Edin), F.S.A. (Scot.)	St. Margaret's, St. Valerie Road
1929	Robinson, Miss M. H.	14 Talbot Avenue
1929	Robinson, Miss W. A.	,, ,,
1928	Robson, Alderman H., J.P.	Mulgrave, Meyrick Park Crescent
1923	Roden, Miss E. M.	14 Campbell Road, Boscombe
1905	Rogers-Barns, Miss	Vergers Mead, Corfe Castle
1914	Rooke, Miss S. G.	Norbury, 53 Paisley Road
1914	*Roper, Miss Ida M., F.L.S.	4 Woodfield Road, Redland, Bristol
1922	Rosling, Mrs.	12 East Avenue
1916	Rothwell, Mrs.	21 Wentworth Avenue, West Southbourne
1925	Ruddle, Mrs. F. J.	12 Richmond Park Crescent
1913	Russell-Cotes, H. V. M.	8 Meyrick Park Crescent

S

1926	Sale, G.	Fixby, Milner Road
1926	Sale, Miss L.	,, ,,
1926	Sale, Miss M.	,, ,,
1926	Sale, V. M.	,, ,,
1929	Saunders, Mrs. M. S.	14 Princess Road
1919	Savage, J. W.	41 Wentworth Avenue, West Southbourne
1927	Sayle, G. M.	Malvernbury, Watcombe Road
1929	Sayle, Miss P. P.	,, ,,
1915	Scholes, Mrs.	Aldourie, Branksome Wood Road
1922	Scholes, R. D.	,, ,,
1922	Scholes, Miss V. O. M. D.	,, ,,
1926	Scollick, Mrs.	Brundon, 2 Surrey Road
1929	†*Scott, Dukinfield H., M.A., LL.D., F.R.S., F.G.S., F.L.S.	East Oakley House, Basingstoke
1919	Scott, G. B., C.I.E.	Glencoy, 80 Surrey Road
1903	oScott, J. H., M.E., M.I.M.C.E.	Kirkby, 22 Linwood Road
1916	ASeeviour, G. C., A.C.P., F.R.H.S.	St. Peter's School House
1926	Seymour, Mrs. A. J.	Regent Hotel, West Cliff
1926	Shann, W. A., M.B.	Sandringham Hall, Wordsworth Road, Worthing
1914	Sharp, C.	Langdon, Parkstone
1919	Sharp, Miss E.	,, ,,
1919	Sharp, Miss F.	,, ,,
1930	Shaw, Rev. Courtney A.	The Dormy Hotel, Ferndown
1927	Sherrard, Miss L. J.	Royal Bath Hotel
1903	**G***oSherring, R. Vowell, F.L.S.	Hallatrow, near Bristol
1907	Sherring, Miss O. L.	,, ,,
1926	Shipman, Lt.-Col. H. J.	28 Surrey Road
1916	Simpson, Rev. E. J. Douglas, M.A.	Maesbury, 3 Cavendish Road
1920	Simpson, N. Douglas, B.A., F.R.M.S., F.L.S.	,, ,,
1927	Sitwell, H. W. W.	Glenconnor, Ferndown
1927	Sitwell, Miss M. R.	,, ,,
1925	Smith, H. H.	9 Cambridge Road
1926	Smith, Mrs.	,, ,,
1918	Smith, Horace, M.A., M.D.	Sunnyhurst, 7 Dean Park Road
1918	Smith, Miss M. A.	Woodside, St. Alban's Crescent
1914	Smyth, W. Johnson, M.D.	Killalief, 534 Holdenhurst Road
1922	Smyth. Miss M.	,, ,,
1915	Smythe, Mrs.	Willstead, 22 Cavendish Road
1920	Smythe, Miss D.	,, ,,
1916	Smythe, Miss K. M.	,, ,,
1919	Snell, S. H., M.D., M.B.O.U.	1 Portman Crescent
1919	Snell, Mrs.	,, ,,
1922	Speakman, Mrs. E.	13 Milton Road
1909	Spencer, J. F.	Glenthorne, 73 Richmond Park Road
1923	Stables, A. D.	Saxthorpe, St. Osmund's Road, Parkstone
1923	Stables, Mrs.	,, ,, ,, ,,
1926	Standring, J.	Naseby Nye, Byron Road, Boscombe
1926	Standring, Mrs.	,, ,, ,,
1923	Starr, Col. W. H., C.B., C.M.G., C.B.E.	4 Foxholes Road, Southbourne
1929	ASteer, Miss B.	18 Parkwood Road, Boscombe
1921	Stevens, C. S.	Goodwin, Howard Road
1928	Stiff, Miss F. M.	Grosvenor Hotel, Chine Crescent
1929	Stiff, Miss M. I.	,, ,,
1916	Stiff, S. J., B.SC.	Norden House, Corfe Castle
1916	Stiff, Mrs.	,, ,,
1916	Stiff, Miss M. J.	,, ,,

1928	Stone, Miss E. J.	7 Strouden Avenue
1929	Stone, Miss M. A.	,, ,,
1920	Stoney, Miss F. A., O.B.E., M.D., B.S.	12 Burnaby Road
1924	Story, F. N.	Storyland, Church Road, Southbourne
1924	Story, Mrs.	,, ,, ,, ,,
1930	Stubbs, Miss A.	Tower House, West Cliff Gardens
1918	G†*Sumner, Heywood, F.S.A.	Cuckoo Hill, South Gorley, Fordingbridge
1928	Sutherland, W.	Silverdale, 20 Penn Hill Avenue, Parkstone
1928	Sutherland, Mrs.	,, ,, ,,
1906	Swallow, E.	York Cottage, Ravine Road, Canford Cliffs
1930	Swetenham, Mrs. E. B. L.	63 Overcliff Drive, Southbourne
1922	ASymes, H., M.A.	52 Lowther Road

T

1911	Tatchell, Leonard, F.E.S.	Swanage,
1915	Taylor, F. B., B.A.	Claregarth, Montague Road, W. Southbourne
1916	Taylor, Mrs.	,, ,, ,, ,,
1916	Taylor, Miss M. W.	,, ,, ,, ,,
1928	Taylor, Mrs. R. A.	17 Dunbar Road
1929	Taylor, Miss N. G. R., M.A.	,, ,,
1923	Thill, Mrs.	8 Colville Road, Boscombe
1925	AThomasson, Miss M. E.	37 Belvedere Road
1927	Thompson, E. H.	86a Wolverton Road
1928	Thompson, Rev. J. C., F.G.S.	Cragside, Manor Road, New Milton
1929	Thomson, A. G. A., M.A., M.B.	38 Wentworth Avenue, Boscombe
1922	Thomson, A. W. Ferguson	Ailsa, Erpingham Road
1928	Thomson, Mrs.	,, ,,
1911	Thomson, Mrs. Roberts	Monkchester, 17 Manor Road
1928	Thornton, Mrs. Sykes	Moorland Court, Queen's Park West Drive
1919	Thoroton, Rev. L. E. W.	Hill House, Spencer Road, Canford Cliffs
1911	Tickell, Miss S. M.	Capri, 90 Richmond Park Avenue
1929	Tucker, Mrs. E. M.	39 Hamilton Road
1911	Turner, J. E.	Bramley, 94 Surrey Road
1914	Twemlow, Miss E. E.	Devon Lodge, 83 Alumhurst Road

V

1929	AVanheems, Miss B.	Convent of the Cross, Boscombe
1913	Veale, Miss A. G.	14 Cecil Avenue
1923	Veale, Miss C. M.	,, ,,
1923	Veale, Miss B.	2 Richmond Park Crescent
1923	Veale, Miss L. H.	,, ,,
1908	Vernon, Lieut.-Col. A. H., L.R.C.P., F.R.C.S.	Drayton, 19 Queen's Park Gardens
1918	AVorse, John	Leighurst, Walkford, Christchurch

W

1903	Go†Waddington, H. J.	Moreton, 107 Lowther Road
1918	*Elected an Honorary Member	
1924	AWadlow, H. J.	The Gables, Queen's Grove, Parkstone
1916	Walby, A. E.	Netherton, 2 Dean Park Road

1921	Wales, Miss	The Nook, 4 Ormonde Road, Branksome Park
1921	Wales, Miss N.	,, ,, ,, ,,
1918	Walker, R. S.	Meyrick Cliffs Hotel
1913	Wallace, W. G.	Doveshill Cottage, Ensbury Park
1912	Walter, Mrs. G. P.	Rusholme, 10 St. Anthony's Road
1920	Wanstall, W. S.	Del Monte, 6 Roslin Road
1920	Wanstall, Mrs.	,, ,,
1927	Ward, H. P.	Braemar, Egerton Road
1928	Watson, Miss E. M.	20 Southwood Avenue
1930	Webb, Mrs. F. J.	6 St. Anthony's Road
1928	AWebber, A. E.	28 Tower Road, Boscombe
1928	Webber, Miss M. A.	Stoke, Stokewood Road
1928	Welfitt-Nicholls, Miss A.	64 Seaward Avenue
1928	Welfitt-Nicholls, Miss C.	,, ,,
1928	Welfitt-Nicholls, Miss E.	,, ,,
1913	Wetherell, Miss M.	Triana, 21 Harvey Road, Boscombe
1920	Wetherell, Miss S.	,, ,, ,, ,,
1918	Whitaker, S.	22 Somerset Road, Boscombe
1930	Whitaker, Mrs.	,, ,, ,,
1924	Whitaker, Miss E. M.	Roseways, Frinton-on-Sea.
1924	Whitaker, S. E., M.S.A.	22 Selwood Road, Addiscombe, Croydon
1921	White, Mrs. E. Sinclair	35 East Avenue
1920	White, J. R., M.A.	Whitecot, 15 Linwood Road
1920	White, Mrs.	,, ,,
1929	Whiteley, F. W.	7 Charminster Road
1928	Wiggins, Mrs. A. L.	Gorseside, Mudeford, Christchurch
1927	Wigmore, A. J., B.A., M.R.C.S., L.R.C.P.	Aymestrey, Tuckton Road, Southbourne
1919	Williams, John	Brynmill, 68 Southcote Road
1926	Williamson, H. J.	Quiddington, Birchwood Road, Parkstone
1924	AWillis, Miss G. H.	116 Paisley Road, West Southbourne
1929	Windsor, Mrs. E.	Craigside, Manor Road, New Milton
1920	Woodhouse, Rev. A. P.	Deanhurst, 5 Littledown Road
1903	oWoodhouse, W. J., A.C.P., M.I.H.	35 Chatsworth Road, Malmesbury Park
1918	Woodhouse, Mrs.	,, ,, ,,
1923	Woodhouse, W. R.	,, ,, ,,
1923	Woodhouse, Miss M. M.	,, ,, ,,
1930	†*Woodward, Sir A. Smith, F.R.S., F.L.S., F.G.S.	Hill Place, Haywards Heath, Sussex
1928	Wright, J.	Ranmoor, Motcombe Road, Branksome

Y

1924	Yates, Rev. A. G., M.A., R.N.	14 Wellington Road
1924	Yates, Mrs.	,, ,,
1924	Yates, Miss E. M. M.	,, ,,
1928	Young, Mrs. E.	Dunelm, Brackendale Road
1929	Young, H. T.	11 Borthwick Road, Boscombe
1929	Young, Miss E.	,, ,,

RULES OF THE
Bournemouth Natural Science Society.

(*As amended, October* 1928.)

Title

1.—The title of the Society shall be THE BOURNEMOUTH NATURAL SCIENCE SOCIETY.

Objects

2.—The objects of the Society shall be:

(*a*) The promotion of the study of Science in all its branches, by means of Lectures, Field Meetings, the Reading and Discussion of Papers, the formation of Sections of its members devoted to any particular branch of the Society's work, and in any way that the Council of the Society shall deem advisable.

(*b*) The making of reports on any animal, plant, or object of interest, and the carrying out of the recommendations contained in such reports.

Members

3.—The Society shall consist of Ordinary, Life, Honorary and Associate Members.

Ordinary Members

4.—Ordinary Members shall pay an Annual Subscription of One Pound, due on the first day of October in each Year. The inclusive Annual Subscription for Adult Members of the same family, not exceeding four and residing in the same house, shall be Two Pounds, each Member being elected in the usual manner and each receiving a card of membership. Persons living outside a radius of six miles from the Square at Bournemouth may be elected Country Members, and pay one half the above rates of subscription.

Life Members

5.—The Subscription for Life Members shall be Ten Pounds. Any Ordinary Member who shall have commuted his Subscription, as provided for in this Rule, shall become a Life Member, but shall not by reason thereof have any rights differing from those of an Ordinary Member.

¶ Rules 5a and 5b referred to in the Trust Deed are Rules 19 and 20.

Honorary Members

6.—Any person distinguished in Science or who has rendered any special service to the Society, may be elected an Honorary Member. Honorary Members shall be proposed and elected in the same way as Ordinary Members. The number of Honorary Members shall be limited to twenty-five.

Associate Members

7.—Persons may be admitted Associate Members by the Council on account of their scientific attainments or because they are likely to prove useful working Members of the Society. This privilege will usually be granted to School Teachers.

The annual subscription for Associate Members shall be seven shillings and sixpence. They shall be entitled to all the privileges of Membership except that they shall have no power of voting on the affairs of the Society or of holding office.

Proposal and Election of Members

8.—The Ordinary, Life, and Associate Members of the Society shall be proposed by a Member to whom they are known personally or to whom they have presented adequate credentials, and seconded by another Member, and the proposal, in the form following these Rules, shall be sent to the Honorary Secretary. The name of any such proposed new Member shall be posted on the Notice Board of the Society for a period of not less than seven days, after which such name shall be voted upon at the next ensuing Council Meeting, and if two-thirds of the Council present and voting shall vote for the proposed New Member, such Candidate shall become a Member upon payment of the Annual Subscription and shall receive a Card of Membership which is not transferable. Any Member joining during August or September shall receive a Card of Membership to September 30th of the following year without further payment.

Unpaid Subscriptions

9.—Any Members whose subscriptions are unpaid at the end of the financial year (September 30th), after notice in writing to that effect has been given to them by the Honorary Treasurer, shall be reported to the Council, which shall have the power of removing their names from the list of members.

Resignations

10.—Resignations must be in writing and addressed to the Honorary Secretary. Members are liable for all subscriptions which may have fallen due prior to the date of resignation.

Executive Officers.

11.—The Executive Officers of the Society shall be the Chairman of Council, the Deputy Chairman of Council, Honorary Treasurer, and Honorary Secretary.

The President

12.—The President shall be elected annually and need not necessarily be selected from Members of the Society. He shall be invited to deliver an Address at as early a date in the Winter Session as can be arranged.

Vice-Presidents

13.—Any Member of the Society who, in the opinion of the Council, has rendered distinguished service to Science or to the Society, shall be eligible for election as a Vice-President at the Annual Meeting and, if elected, shall retain office as long as he remains a Member of the Society.

Chairman of General Meetings

14.—The President or a Vice-President shall take the Chair at all General Meetings other than the Annual and Special Meetings. At these the Chairman of Council or Deputy Chairman shall preside.

Honorary Secretary

15.—The Honorary Secretary shall perform all the usual secretarial work, shall keep minutes of all Council Meetings, and of the Annual and Special Meetings, and make a synopsis of all other General Meetings. He shall cause the agenda of the Annual and Special Meetings to be sent to every Member seven days at least before each such Meeting. He shall make all preparations for General Meetings and General Excursions, in respect of which he shall collect from each Member his share of the expenses, and therefrom defray all costs of the Meetings or Excursions.* Any surplus of such collections shall go to the General Fund, and any deficit be defrayed out of that Fund. He shall keep an account of all out-of-pocket expenses. He shall give notice of their election to all new members, and register the Sections, if any, to which they ask to belong. He shall furnish copies of the Annual Reports published during their membership, to all Members who have paid their subscriptions, the number of copies of the "Proceedings" supplied in respect of each family subscription shall not exceed two; to Honorary Members, and to such Scientific Societies as the Council may from time to time appoint to receive them.

*Note.—Tickets may be returned and the money refunded up to the expiration of the time for taking tickets for any Excursion; after that date, no money can be refunded even if the tickets are not used.

Honorary Treasurer

16.—The Honorary Treasurer shall have the custody of the General Funds of the Society. He shall receive and acknowledge all Subscriptions, and shall issue tickets of Membership to all persons who are duly elected and have paid their Subscriptions. He shall bring before the Council any accounts that are due for payment. He shall prepare a financial Statement at the end of each Financial Year to be presented to the Council at the Meeting next preceding the Annual Meeting. After presentation of the Financial Statement to the Council, he shall submit it to the Auditors and lastly to the Annual Meeting of the Society.

Council

17.—There shall be a Council of the Society consisting of the Vice-Presidents who have filled the office of President, the Honorary Treasurer, the Honorary Secretary, the Honorary Librarian, the Honorary Editor, the Honorary Curator, the Chairmen of Sections, not more than ten Members elected by the Society and not more than two co-opted Members.

18 (*a*).—The Council shall have the general management of the Society and the control of its funds. At all Meetings of the Council, five shall form a quorum. The Council shall elect its own Chairman and Deputy Chairman for the Year, shall have power to fill up vacancies in its number, and to co-opt not more than two additional members. The Council shall have power to appoint Committees to deal with any business that may be delegated to them.

(*b*) The Chairman, or in his absence the Deputy Chairman, shall have an original and a casting vote at all Meetings of the Council.

(*c*) The Council shall arrange all Lectures, Papers, Demonstrations and Exhibitions of Specimens, etc., for the General Meetings and Excursions of the Society, and shall approve of all arrangements for Sectional Meetings and Excursions before they are included in the monthly programme.

(*d*) If any elected or co-opted member of the Council shall fail to attend four consecutive Meetings of the Council, his seat shall become vacant unless the Council shall decide otherwise.

Trustees

19.—The property of the Society shall be vested in Trustees who shall be elected by the Council. The number of Trustees shall be not more than nine or less than three, and they shall respectively hold office until death or resignation, unless removed from office by a resolution of the Council. The Trustees shall from time to time deal with the property of the Society as directed by resolution of the Council (of which an entry in the minute book shall be conclusive evidence), and they shall be indemnified against all liability whatsoever out of the property for the time being of the Society.

¶ This Rule is referred to in the Trust Deed as Rule 5a.

Borrowing Power

20.—If at any time the Society in general meeting shall pass a resolution authorising the Council to borrow money, the Council shall thereupon be empowered to borrow for the purposes of the Society such amount of money, either at one time or from time to time, and at such rate of interest, and in such form and manner, and upon such security as shall be specified in such resolution, and thereupon the Trustees shall make all such dispositions of the property of the Society or any part thereof, and enter into such agreements or arrangements in relation thereto, as the Council may by resolution direct for giving security for such loan or loans and interest thereon at the agreed rate. All members of the Society, whether voting on such resolution or not, and all persons becoming members of the Society after the passing of such resolution shall be deemed to have assented to the same as if they had voted in favour of such resolution.

¶ This Rule is referred to in the Trust Deed as Rule 5b.

Visitors

21 (*a*).—A Member may introduce friends who accompany him to all parts of the Society's premises except those which are let or in use for a Lecture or Meeting. The Member must enter the names and addresses of such Visitors in the Visitors' Book and sign the entry. Strangers cannot be admitted on presenting a Member's card or letter.

(*b*) A Member may introduce two Non-Members, who accompany him, to any Lecture or Excursion of the Society, but no Non-Member may be thus introduced to more than two Lectures in the Winter Session and two Excursions in the Summer Session, even though introduced by different Members. In the case of Lectures, the introducing Member must enter the names and addresses of the Visitors in the Visitors' Book and sign the entry. In the case of Excursions, the introducing Member must send the names and addresses to the Organiser of the Excursion.

(*c*) A Member introducing a Visitor is responsible for ascertaining that the Visitor has not been introduced twice previously in that Session and also that the privilege is not used for commercial purposes.

(*d*) A Visitor to Bournemouth may, with the approval of the Council, be granted a ticket enabling him to attend the Meetings and Excursions of the Society for a period not exceeding six months at a charge of Fifteen Shillings.

(*e*) The Council shall have power to extend the hospitality of the Society to distinguished Visitors.

(*f*) The Council shall have power temporarily to alter or suspend this Rule or any part of it.

NOTE.—Nothing in this Rule shall prevent the Chairman of a Section from introducing, at any time, a non-member who offers a communication of interest to his Section.

Charges for Meetings

22.—The Council shall have power to make a charge to Members for admission to any Meeting the holding of which involves special expenses, and may arrange for the admission of Non-Members.

Expulsion

23.—The power of expulsion of a Member from the Society for objectionable conduct shall be vested in the Council and exercised at a Special Meeting called for that purpose. Notice of the proposed expulsion must be given on the circular convening the Meeting. The expulsion must be carried by a majority of two-thirds of those present.

The Member affected shall have power to appeal to a General Meeting of the Society to act by the like majority.

Annual and Special Meetings

24 (*a*).—The Annual Meeting shall be held in the month of October.

(*b*) At this Meeting the President, the Chairmen of Sections, the Honorary Treasurer, the Honorary Secretary, the Honorary Librarian, the Honorary Editor, the Honorary Curator, not more than ten Members of the Council and two Auditors for the ensuing year shall be elected, either Auditor having the power to audit the accounts in the absence of the other.

(*c*) At this Meeting the Council's Report for the past year, and the Honorary Treasurer's statement of accounts duly signed by the Auditors, shall be submitted.

(*d*) Notice convening an Annual or Special Meeting, together with the agenda and details of any proposed alterations in the Rules, shall be given to Members at least seven clear days before such Meeting is held. Notice of General Meetings shall be given at least seven clear days beforehand.

(*e*) On a written Requisition, signed by at least ten Members of the Society, the Council shall call a Special Meeting to consider any question as to the affairs of the Society, such Meeting to be called within three weeks of the Council Meeting next following the receipt by the Honorary Secretary of the Requisition, and at least seven clear days' Notice shall be given to the Members. At such Meeting no other business than that mentioned on the Requisition, and on the notice convening such Meeting, shall be considered.

(*f*) At the Annual Meeting and at all Special Meetings of the Society, not less than twenty-five Members shall form a quorum.

Sections

25 (*a*).—The Council shall have power to form a Section for the study of any special subject deemed within the scope of the Society's work, and shall appoint the Chairman for the first year.

(*b*) The Chairman of each Section shall appoint a Secretary for the Section, who, in addition to the ordinary secretarial duties, shall keep a list of the Members of the Section.

(*c*) A Section shall consist of those Members who have signified to the Honorary Secretary or the Secretary of the Section their wish to belong to that Section.

(*d*) The Members of each existing Section shall, at a Meeting held before the last week in July in each year, nominate the Chairman of the Section for the ensuing year to come into office after the Annual Meeting. The Secretary of the Section shall send such Nomination to the Honorary Secretary in time to present it at the Council Meeting held on the last Monday in July.

(*e*) If the Council approve of the Nomination, it shall recommend the person nominated for Election at the Annual Meeting, otherwise it shall refer the matter back to the Section. In the event of a Section failing to nominate a Chairman, the Council shall have the right to do so. The final Election shall take place at the Annual Meeting.

(*f*) At the request of the Sectional Chairman the Secretary of a Section may attend Meetings of the Council, but without the power of voting.

(*g*) Each Sectional Chairman shall be responsible for the preparation and arrangement of each Sectional Meeting and Excursion, and shall furnish details of the same to the Honorary Secretary for submission to the Council. At the end of each Session he shall render to the Honorary Treasurer an account of his receipts and payments for the Section.

NOTE.—As under Rule 15.

(*h*) A Minute Book for each Section shall be kept in which shall be entered details of the Section's work and an account of all Sectional Meetings, with the number of Members attending and notes on any matters of interest observed or discussed. Such book shall be submitted to the Council whenever required. The Chairman of each Section shall send to the Honorary Secretary a report of the Council's work for the year in time for it to be epitomised in the Council's Report to the Annual Meeting.

Alteration in Rules

26.—Alterations in the Rules must be sanctioned by a majority of not less than two-thirds of the Members present and voting at the Annual Meeting, or at a Special Meeting called for that purpose, and no alterations shall otherwise be made.

To the Honorary Secretary,

Bournemouth Natural Science Society,

39, CHRISTCHURCH ROAD, BOURNEMOUTH.

Dear Sir,

I beg to propose that

M..

(Please give Christian name in full, and state title—Mr., Mrs., Miss, etc., and any degrees or qualifications.)

Address..

....

**who is personally known to me*
**who has produced satisfactory credentials to me* *be elected an* **Ordinary* **Associate*
Member of the Society.

Date.................. *Member's Signature* ....

I beg to second the above proposal

Date.................. *Member's Signature*..................................

*Delete word not applicable. See extract from Rules on reverse of this form.

FORM OF LEGACY.

The following Form of Bequest is recommended for adoption by those who may be desirous of leaving by Will money for promoting the objects and work of the Society :—

I give absolutely to the Treasurer for the time being of the Bournemouth Natural Science Society of No. 39 Christchurch Road, Bournemouth, for the general purposes of the Society the sum of £ s. d. free of duty, and I declare that the receipt of the said Treasurer for the time being shall be sufficient discharge for the said legacy.

Annual Meeting, 1930.

THE Twenty-seventh Annual Meeting was held on Saturday, October 25th, at 3 p.m., the chair being taken by the Rev. C. O. S. Hatton. The Minutes of the last Annual Meeting were read and approved.

The Council's Report and the Statement of Accounts for the year were adopted on the proposal of Dr. Crallan, seconded by Mr. John Williams.

A cordial vote of thanks to the retiring President, Professor F. O. Bower, D.Sc., F.R.S., was moved by Col. E. B. Anderson, seconded by Rev. Prof. Potter and carried. The election to the vacant office of Mr. Henry Bury, M.A., F.L.S., F.G.S., having been proposed by the Chair and carried by acclamation, Mr. Bury was declared duly elected President for 1930. There followed the election of Officers, proposed by Dr. Robertson and seconded by Mr. F. B. Taylor; of the Council, after a ballot among 15 candidates, proposed by Mr. Hayes Barratt and seconded by Mr. Arthur Gray; and of Chairmen of Sections, including, in the Microscopical Section Mr. F. W. Parrott, and in the Photographic Section Mr. S. Whitaker; proposed by the Chair and seconded by Miss B. Veale.

Mr. Wadlow proposed the re-election of the Hon. Auditors, with thanks for their past services. This was seconded by Miss Fryer, and carried.

Miss Marcia Penrose proposed and Mr. J. R. White seconded a slight alteration in Rule 6, increasing the legal number of Honorary Members from twenty to twenty-five. This was approved.

A vote of thanks to the Officers of the Society was moved by Miss Penrose, seconded by Mr. Bury, and carried.

The Chairman received the thanks of the Meeting on the proposition of Colonel Dundee, supported by Mr. F. W. Longbottom.

Council's Report, 1930.

THE Council has pleasure in presenting its Twenty-seventh Annual Report. Our Members now number 606, as against 611 last year, including 20 Honorary Members, 23 Associates, 9 Original Members, and 12 Past Presidents.

During the past year the following have been held :—

Annual Meeting
Presidential Address
17 General Meetings
7 ,, Excursions
71 Sectional Meetings
32 ,, Excursions

making a total of 129.

GENERAL.

Lectures and Meetings.

(*Illustrated by Lantern Slides.)

1929.	
Oct. 19.	Annual Meeting.
Oct. 21.	Club Day.
Oct. 26.	Presidential Address. " The Mechanical Construction of Plants " by Professor F. O. Bower, D.Sc., F.R.S.
Nov. 6.	Club Day.
*Nov. 30.	" Recent Excavations in Palestine," by Miss Olga Tufnell.
Dec. 9.	Club Day. " Books and our Library," by Mr. Claude Lyon.
*Dec. 21.	" Scotland," by Mr. R. K. Cardew, B.A.
1930.	
*Jan. 7.	Children's Lecture, " Curiosities in Nature and Science," by Mr. Claude Lyon.
Jan. 13.	Club Day.
Feb. 17.	,,
*Mar. 8.	" In Bruges and Ghent with a Camera," by Mr. E. Dodshon,, LL.B.
Mar. 10.	Club Day.
Apr. 11.	,,
May 8.	,,
June 10.	,,
July 12.	,,
Aug. 28.	,,
Sept. 20.	Garden Fête.
Sept. 23.	Club Day.

Excursions and their Leaders.

1930.	
May 22.	Basing, Mr. H. A. Richey, B.A.
June 5.	Minley Manor, Mr. Claude Lyon.

June 18.	Lacock and Potterne, Mr. E. Dodshon, LL.B.
July 10.	Wilton House, Mr. Herbert Smith.
July 22.	Savernake and Marlborough, Dr. B. W. Nankivell, M.R.C.S., L.R.C.P.
Aug. 18.	Arundel Castle, Mr. E. Dodshon, LL.B.
Sept. 5.	Old Sarum and Stonehenge, Dr. S. H. Snell, M.D.

SECTIONAL.

Archæological and Historical Section.

Lectures and Meetings.

1929.	
*Nov. 2.	"Athens, Constantinople, Baalbec and Cairo," by Col. W. J. Dundee, C.I.E., F.R.G.S.
Nov. 18.	"Further Notes on West Parley," by Lt.-Col. C. D. Drew, D.S.O., F.S.A.
Dec. 7.	"Linear Earthworks," by Dr. J. P. Williams-Freeman.
1930.	
Jan. 9.	"Memorial Rubbings," by Dr. Dru-Drury.
Feb. 1.	"The Roman Legions" (Part I.) by Mr. H. A. Richey, B.A.
*Feb. 15.	"Peterborough and Lichfield Cathedrals," by Mr. S. E. Whitaker, A.R.I.S.
Feb. 26.	"The Roman Legions" (Part II) by Mr. H. A. Richey, B.A.
Mar. 1.	"The Study of Local History," by Mr. F. J. Weaver, M.A.
Mar. 26.	"Combs Ditch and Bokerley Dyke reviewed," by Mr. Heywood Sumner, F.S.A.
*Oct. 22.	"Romsey Abbey," by Mr. R. M. Fanstone.

Excursions and their Leaders.

1930.	
May 14.	Bokerly Dyke, Mr. Heywood Sumner, F.S.A.
June 3.	Meon Valley and Corhampton, Mr. R. K. Cardew, B.A., and Col. E. B. Anderson, C.B.E.
June 20.	Combs Ditch, Weatherby Castle, and Bere Regis Church, Mr. Heywood Sumner, F.S.A., and Mr. R. K. Cardew, B.A.
Aug. 12.	St. Catherine's Hill, Winchester; Longstock and Danebury, Dr. J. P. Williams-Freeman.
Sept. 11.	Milford Church, Lymington, and the Norman House and Castle, Christchurch, Mr. R. K. Cardew, B.A., and Col. E. B. Anderson, C.B.E.

Astronomical Section.

Lectures and Meetings.

1929.	
*Oct. 23.	"The Evolution of Suns," by Mr. J. Arthur Formoy, F.R.A.S.
*Nov. 23.	"Meteors," by Mr. F. W. Longbottom, F.R.A.S.
1930.	
*Jan. 25.	"The Moon," by Mr. Walter Goodacre, F.R.A.S.
*Feb. 19.	"The Causes of some Simple Phenomena," by Mr. L. B. Benny, M.A., F.R.A.S.

*Mar. 19.	" The Sun," by Mr. J. Arthur Formoy, F.R.A.S.
*Oct. 18.	" The Pleiades," by Mr. J. Arthur Formoy, F.R.A.S.

Botanical Section.

Lectures and Meetings.

1929.	
Nov. 12.	" Life History of some Local Fungi " by Mr. J. Vorse.
Dec. 5.	" Sections of Palaeozoic Plants," by Dr. Dukinfield H. Scott, M.A., F.R.S., F.L.S.
Dec. 19.	" Some Natural History Fallacies," Part I. by Mr. L. Beeching Hall, F.L.S.
1930.	
*Jan. 21.	" Plants Seen in 1929," by Mr. L. Beeching Hall, F.L.S.
*Jan. 28.	" Transformations of the Plant World," Part I. by Dr. Dukinfield H. Scott, M.A., F.R.S., F.L.S.
Feb. 8.	" At Home."
Feb. 11.	" The Colours of Flowers," by Col. W. J. Dundee, C.I.E., F.R.G.S.
*Mar. 6.	" Transformations of the Plant World," Part II. by Dr. Dukinfield H. Scott, M.A., F.R.S., F.L.S.
*Mar. 25.	" The Cell Structure of Plants," by Dr. W. A. Shann.
April 17.	" Some Natural History Fallacies," Part II. by Mr. L. Beeching Hall, F.L.S.

Excursions and their Leaders.

1929.	
Oct. 29.	Fungus Foray, Rev. Professor M. C. Potter, M.A., D.Sc., F.L.S.
1930.	
April 29.	Hinton Martel and Chalbury, Mr. R. K. Cardew, B.A.
May 6.	Sway, Mr. J. Vorse.
May 13.	Corfe, Surg.-Capt. G. G. Borrett, R.N.
May 20.	Beckley, Rev. C. O. S. Hatton, B.A., F.L.S.
May 27.	East and West Parley, Miss S. G. Rooke.
June 4.	Hinton Admiral Gardens, Rev. C. O. S. Hatton, B.A., F.L.S.
June 13.	Stourpaine, Mr. R. K. Cardew, B.A.
June 16.	Pepperbox Hill, Mr. H. J. Wadlow.
June 24	Studland, Mr. H. J. Wadlow.
July 3.	Holmsley, Rev. Professor M. C. Potter, M.A., D.Sc., F.L.S.
July 8.	Wool, Mr. R. K. Cardew, B.A.
July 15.	Brockenhurst to Beaulieu Road, Mr. L. Beeching Hall, F.L.S.
July 24.	Swanage, Mr. H. J. Wadlow.
Aug. 14.	Shapwick, Mr. R. K. Cardew, B.A.
Aug. 26.	Hengistbury Head, Mr. L. Beeching Hall, F.L.S.
Sept. 2.	Mudeford to Highcliffe, Mr. J. Vorse.
Sept. 8.	Wareham, Mr. H. J. Wadlow.
Sept. 25.	Keyhaven, Rev. Professor M. C. Potter, M.A., D.Sc., F.L.S.
Oct. 14.	Fungus Foray, Rev. Professor M.C. Potter, M.A., D.Sc., F.L.S.

Entomological Section.

Lectures and Meetings.

1929.	
Nov. 21.	" The Comma Butterfly (Polygonia c-album)," by Mr. Alan Druitt, F.E.S.

1930.
Jan. 16. "Notes on British Sphingidae (Hawk-moths),"
by Dr. G. E. J. Crallan, M.A., M.B., M.R.C.S.
Feb. 20. "The Timber Saw-fly (Sirex gigas),"
by Mr. Alan Druitt, F.E.S.
Mar. 20. "Ophiodes lunaris,"
by Dr. G. E. J. Crallan, M.A., M.B., M.R.C.S.
Oct. 16. Specimens observed and collected in 1930.

Geographical Section.

Lectures and Meetings.

1929.
*Oct. 30. "Travelogue,"
by Alderman H. Robson, J.P.
Nov. 14. "The Probabilities of Ancient Transport,"
by Mr. Landseer Mackenzie.
*Nov. 28. "Islands,"
by Dr. G. E. J. Crallan, M.A., M.B., M.R.C.S.
1930.
*Jan. 11. "A visit to Crete and Greece," Part I.
*Jan. 14. ,, ,, Part II.
by Miss E. E. Twemlow.
*Feb. 18. "A remote Severn Town,"
by Miss F. C. Miller.
*Mar. 24. "The Old Dutch Spice Isles of the East Indies,"
by Mr. E. E. Long, C.B.E.
*April 5. "Some Indian Temples and Mosques,"
by Mr. Claude Lyon.
*April 26. "On the Borders of North Italy,"
by Mr. G. W. Bater, B.A.
May 3. "At Home."
*Oct. 13. "Bali—the Wonder Isle of the Malay Archipelago,"
by Mr. E. E. Long, C.B.E.

Excursions and their Leaders.

1930.
May 30. Romsey, Burley and the Rufus Stone, Mr. Claude Lyon.
June 26. Hadspen House and the Hood Monument, Mr. Claude Lyon.

Geological Section.

Lectures and Meetings.

1929.
*Nov. 9. "Glacial Epochs and their Causes," Part I.
*Dec. 12. ,, ,, Part II.
by Mr. Henry Bury, M.A., F.G.S.
1930.
*Jan. 22. "The Geology of the Weald,"
by Rev. J. I. C. Thompson, F.G.S.
Feb. 5. "Coast-Lands Erosion,"
by Mr. R. K. Cardew, B.A.
*Mar. 29. "Prehistoric Monsters in this District,"
by Rev. C. V. Goddard, M.A.
April 23. "Some Geological Specimens in our Museum,"
by Mr. E. St. John Burton, F.L.S., F.G.S.

Excursions and their Leaders.

1930.
June 17. Coggins Barrow, Mr. E. St. John Burton, F.L.S., F.G.S.
Aug. 8. Blashenwell and St. Aldhelm's Head. Mr. Henry Bury, F.G.S.
Sept. 22. Barton Cliffs, Mr. E. St. John Burton, F.L.S., F.G.S.

Microscopical Section.

Meetings.

1929.
Nov. 21. Exhibition of Objects of Interest.
Dec. 5. ,, ,,
Dec. 19. ,, ,,
1930.
Jan. 16. ,, ,, (the Polariscope)
Feb. 20. ,, ,, (Legs of Insects)
Mar. 20. ,, ,, (Algae)
Apr. 17. ,, ,, (Mouths of Insects, &c.)
May 15. ,, ,,
June 19. ,, ,,
July 17. ,, ,,
Aug. 21. ,, ,,
Sept. 18. ,, ,,
Oct. 16. ,, ,,

Photographic and Record Section.

Lecture.

1930.
*Mar. 15. "Peregrinations in Pembrokeshire,"
by Mr. H. J. Williamson.

Excursion and Leaders.

Aug. 29. Mottisfont Abbey, and the Test Valley Villages,
Mr. S. Whitaker and Mr. E. Dodshon, LL.B.

Physical Section.

Lectures and Meetings.

1929.
*Nov. 16. "The Development and Present Position of Physical Science,"
by Miss Marcia Penrose, B.Sc.
*Nov. 26. "Modern Tendencies in Architecture and Decoration, and the part Electricity plays therein,"
by Mr. G. S. Francis.
*Dec. 14. "Water,"
by Rev. E. H. Horne, M.A.
1930.
*Jan. 18. "Portland Cement,"
by Mr. T. H. Littlewood, M.A., B.Sc., F.Phys.S.
Feb. 13. "Silica; its uses in the Arts and Industries,"
by Miss Marcia Penrose, B.Sc.
Mar. 13. "Wave Motion,"
by Mr. R. M. Clark, B.Sc.
June 12. "At Home," with a Demonstration of Cellular and Artificial Silk, by Miss S. I. C. Ingram, B.Sc.

Zoological Section.

Lectures.

1930.
*Jan. 2. "The Taxinomic Value of the Bones at the Base of a Bird's Skull,"
by Dr. F. G. Penrose, M.D., M.R.C.P., F.Z.S., M.B.O.U.
Feb. 22. "The British Owls,"
by Dr. S. H. Snell, M.D., M.B.O.U.

Excursion and Leader.

1930.
July 1. The Zoological Gardens, Regent's Park.
Mr. Bernard Gorton, M.R.C.V.S., M.P.S.

The Council has much pleasure in announcing the nomination of Mr. Henry Bury, M.A., F.L.S., F.G.S., for the office of President for the coming year.

The partial reconstruction of the Building necessitated by the erection of the new Hall has resulted in a general improvement in the accommodation for the Museum and the Library.

The heavy debt on the Hall Building Fund has been partially relieved by a handsome donation of £100 from Dr. Penrose, and by substantial amounts received, firstly from the Mill House Players, as a result of the performance of "Iolanthe," and secondly from a Fête organised by the Chairman of the Council. In two short Plays Mr. Hatton combined with Miss Clutterbuck, assisted by Mr. George Stone and Mr. R. H. S. Hatton; and between these came a Parade of Historical Costumes of the period 1830 to 1930, lent and worn by members of the Society. The display was kindly arranged by Mrs. Heasman, and appropriate dances by Miss Margaret Robinson. This novel fixture attracted 230 members. The Council wish to express their sincere thanks to all those who in these various ways have made such valuable contribution to the Fund.

An unlooked-for expense of £60 has been incurred as a result of the heavy December gales, which dislodged some ridge tiles and revealed decayed woodwork beneath.

The Council deeply regret the retirement of Mr. Backhouse through failing health. He had assisted at its deliberations for 24 years, and the Garden, which had been his special province, owes practically everything to his generosity and his assiduity. They deplore also the decease of four other Councillors, whose places will be hard to fill, and the details of whose work will be found in this Volume, page 118 to 120. Another Original Member has passed away in the person of Mrs. Waddington, who, though no longer a member of the Society, had carried on practical scientific work with unremitting attention, as assistant to her husband, Mr. H. J. Waddington. In acknowledging the award of the Society's Gold Medal in 1922 Mr. Waddington paid a high tribute to her patient help and assistance, adding that "in the series of the Ecdyses of a Lobster, now in the Natural History Museum at South Kensington, which occupied some six years in collecting, and involved constant, if not to say daily, observation and attention, her help was untiring, and I do not think that this series would have matured without it."

Other losses through death include Mr. W. Jones, Miss B. M. Hartree, Mrs. Pilkington, Mrs. Johnson Smyth, Mrs. A. W.

Waters, Miss M. G. West, Mrs. Chadworth-Musters, and Rev. E. Wells.

The experiment of " Club-Day," a monthly meeting for informal scientific and social intercourse, has proved sufficiently attractive to warrant its continuance.

" IN " and " OUT " notice-boards have been fixed at the gates to facilitate traffic.

The Exhibition of Wild Flowers at the Lansdowne has been carried on with its customary success.

The National Union of Teachers held their Annual Conference this year in Bournemouth. The Council had pleasure in opening our Museum for inspection, in permitting the inclusion in their Handbook of two articles from our " Natural History of Bournemouth," and in assisting in the organization of their excursions.

The question of a Municipal Museum having been raised in certain influential quarters in the borough,—a measure strongly advocated by the Society so far back as 1912 (vide Proceedings vol. IV. page 13),—a letter in support of the proposal has been sent to the Borough Council, but has not yet received a reply.

At the Annual Meeting of the S.E. Union of Scientific Societies our delegate was Col. E. B. Anderson, C.B.E. ; and at the British Association Meeting in Bristol our delegates were Messrs. Claude Lyon and John Williams.

Gifts from members are detailed in the Library and Museum Reports.

In conclusion the Council sincerely thanks the ladies of the Tea-Committee for their services, as also members who have worked the lantern, and who have distributed the " Proceedings," and all those, whether members or not, who have given Lectures or helped towards the success of Excursions.

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Summary of Accounts for the Year ending 30th September, 1930.

RECEIPTS.

	£	s.	d.
Current A/c.			
Members' Subscriptions	507	7	6
Donations to General Fund	4	12	6
Sale of Proceedings of the Society	0	10	6
Rent from Tenants	133	15	0
Letting of Hall, etc.	2	12	6
Donations for Library	2	12	6
Donations for purchase of models of Fungi ...	5	0	0
Refund from Bournemouth Education Committee of Cost of Wild Flower Exhibition 1929	1	5	9
Surplus from Excursions	14	14	10
Sundry	1	19	6
	674	10	7
Balance from 1929	149	3	4
	£823	13	11

PAYMENTS.

	£	s.	d.	£	s.	d.
Interest on Debentures	204	0	0			
Less Tax	43	7	0			
				160	13	0
Interest on Loans	9	7	11			
Less Tax	2	1	1			
				7	6	10
Income Tax under Schedule D ...				8	7	0
Maintenance of the Society's House:—						
Rates and Property Tax ...	99	8	0			
Water, Light and Heat ...	54	11	6			
Wages	83	1	10			
Insurances	16	4	7			
Share of Telephone	3	3	0			
Furnishing and Upkeep ...	81	5	6			
				337	14	5
Secretarial Expenses:—						
Printing and Stationery ...	47	12	2			
Postage	33	17	11			
Other Expenses	15	0	0			
				96	10	1
Maintenance of Garden:—						
Wages	20	13	0			
Other Expenses	0	3	0			
				20	16	0
Special Expenses of Library ...				13	2	2
Special Expenses of Lectures ...				1	2	6
Subscriptions to other Societies ...				0	17	6
Cost of Wild Flower Exhibition in 1929				1	5	9
Cost of Vol. XXI. of Proceedings of the Society				58	2	11
Part Cost of Vol. XXII. of ditto ...				1	12	6
Models of Fungi				5	0	0
Transferred to Building Fund ...				100	0	0
Sundries				1	19	7
				814	10	3
Balance carried forward				9	3	8
				£823	13	11

Summary of Accounts for the Year ending 30th September, 1930.

Deposit A/c. Debenture Fund.

	£	s.	d.		£	s.	d.
Balance brought forward	134	10	8	Paid for Chairs	75	9	2
Donations for Purchase of Chairs	15	2	4	Transferred to Building Fund	50	0	0
Life Membership Subscriptions	20	0	0				
Interest to Dec. 31st, 1929	2	7	11		125	9	2
				Balance on deposit	46	11	9
	£172	0	11		£172	0	11

Building Fund.

	£	s.	d.		£	s.	d.
Balance brought forward	181	1	9	Paid to Builders on completion	799	2	2
Donations	304	10	4	Paid for Extra Fittings	5	11	9
Loans	305	0	0	Architect's Fee	104	3	9
Transferred from Current A/c.	100	0	0				
Transferred from "Debenture" A/c.	50	0	0		908	17	8
Interest to Dec. 31st, 1929	8	8	5	Balance on deposit	40	2	10
	£949	0	6		£949	0	6

Archæological Research Fund.

	£	s.	d.		£	s.	d.
Balance brought forward	15	10	10	Balance on Deposit	15	18	4
Interest to Dec. 31st, 1929	0	7	6				
	£15	18	4		£15	18	4

G. BRUMELL,
Hon. Treasurer,
1st October, 1930.

We have examined the above Accounts with the Books of the Society and Vouchers for payment, and certify the same to be correct.

(Signed) EDWD. BICKER & SON,
Incorporated Accountants.
FREDERIC BROAD,
Hon. Auditor

Bournemouth,
October 20th, 1930.

Financial Note.

When the Society's property at 39 Christchurch Road was purchased the money required was raised by the issue of 6 per cent. Mortgage Debentures. The amount authorised was £3,400, but only £3,250 was issued at the time. Up till 1929 £250 had been redeemed on the death of holders, the amount outstanding thus being reduced to £3,000.

The donations to the New Hall Building Fund fell considerably short of the amount required, and on the completion of the building the Council decided to re-issue the £250 debentures that had been redeemed and to issue the £150 that had not before been issued; the full authorised amount of £3,400 is therefore now outstanding.

As a further amount was still required to pay for the new hall, loans were invited, and the sums of £280 at 5 per cent. interest and £125 free of interest were received. These sums were to be repayable in three years, and are secured on the personal guarantee of various members. The amount borrowed has since been reduced to £305, through the generosity of Dr. Penrose, who has presented to the Society the £100 which he had lent.

It will be seen that, though the builder's and architect's charges have been paid, there is still a debt of about £700 on the new hall, due to the Debenture holders and those who have advanced money on loan. The security for the Debentures is considered to be very ample, and the Society's position is quite sound; but the large annual amount that has to be paid in interest makes it necessary that rigid economy should be practised.

The Building Fund is still open, and it is hoped that considerable donations may yet be given by those who use and appreciate the new hall. Any money received will of course be devoted to paying off the debt, thereby reducing the amount of interest payable. As the yearly charges are reduced it will become easier to provide a sinking fund for the regular repayment of Capital obligations.

Report of Summer Excursions, 1930.

Bokerly Dyke and Combs Ditch. These two excursions formed a most interesting sequel to the paper read by Mr. Sumner on March 22nd, which is reprinted on page 99 of this volume. Bokerly Dyke, which was visited on May 14th, cuts the main road, roughly half way between Salisbury and Blandford, Combs Ditch lies near the same road in its continuation to Dorchester. On both occasions the party enjoyed the leadership of Mr. Sumner, who was able to drive home on the spot the salient points of his lecture.

Weatherby Castle and Bere Regis. The later excursion, on June 20th, was continued to Weatherby Castle under the guidance of Mr. Cardew. This ancient camp occupies a commanding position on the south end and the highest part of high ground 300 feet above sea level. The entrance is on the west, and the place is slightly defended on the south-west and south by the fall of the hill, of no great steepness. The centre, now densely wooded, and bearing an obelisk, rises above its defences, a fairly level plateau standing between the inner and outer set of earthworks. A slight concavity indicates the position of the outer ditch now filled in with material from the rampart. Half a mile to the south runs the Roman road from Badbury to Dorchester.

All this was practically new ground for the Society, though mention is made in our records of a visit to Bokerly Dyke in 1908. On the home journey from Weatherby a halt was made at Bere Regis, where a paper by Mr. Richey was read, giving a detailed history of the locality and, in particular, of the Church.

Basing. This excursion on May 22nd was in the nature of an experimental effort to probe the resources of the more remote regions of Hampshire. Mr. Richey had very carefully worked out the itinerary, involving a huge detour by Salisbury, Stockbridge and Whitchurch and so on without delay to Basing House. Here local guidance was offered by Mr. Willis of Basingstoke, who gave an interesting account of the fall of the house in the Civil War. It was held and stubbornly defended by John Paulet, fifth Marquis of Winchester, against repeated attacks by the Parliamentarian forces, firstly under Waller, who was compelled to withdraw after a vain struggle lasting six months. Then followed a long siege for over a year in an unavailing effort to starve the garrison out. When all failed, down came Cromwell himself with six additional regiments, and in his masterful way carried the house by assault and " slighted " it in thorough fashion, plundering, firing, and levelling the defences almost to the foundations. Above these, all that remains of this stately mansion, which with its garden and entrenchments covered 14 acres, is little more than a few brick walls and the 16th century gatehouse.

It is easy to understand that in the interchange of civilities between the garrison and the besiegers the adjacent village must have been roughly handled. In particular the Church was grievously injured; the upper story of the Tower crashed, and in its fall the roofs of the Chancel and of the North-East Chapel were destroyed and the Nave utterly wrecked. The Choir and the South-East chapel were almost uninjured, and also the Paulet tombs. But the most remarkable survival is the figure of the Virgin and Child in a niche over the west doorway, which somehow escaped mutilation. The mural monuments of the six Dukes of Bolton are in good preservation as also is the font, a good example of 15th century work.

After the Civil War the Church was restored, largely with the help of material from the ruins of Basing House. From the same source probably came the West Doorway, which is not ecclesiastical in design. The three west windows were reset inside out. Subsequent restorations have left their mark on the fabric, and the living itself, originally a rectory,—Basing being in fact the mother church of Basingstoke,—after an interlude of dependence on the latter, was re-established as a vicarage about the middle of the last century.

Romsey, etc. On the way to Romsey on May 30th a visit was paid to Byways, near Burley, by the kind invitation of Mr. Doncaster, to see the remarkable Rock Garden which he has laid out there, the rocks from quarries in Westmorland, and innumerable plants from different parts of the world. Here also a Home Industry in dyeing and weaving has been successfully established by Miss Doncaster.

Corhampton and East Meon. It is only three years since the Society's last visit to Corhampton, an account of which may be found in Vol. XIX of the Proceedings. On June 3rd a further exploration of the Meon Valley revealed fresh interest. Along this little river in its course of some 20 miles is a string of 12 villages, eight of which have churches more than 600 years old. Notable among these is East Meon, where the tower and transepts are Norman, with later spire. Here is one of the four Hampshire examples of large, square Norman fonts of black, basaltic stone, still quarried in Hainault (one of these is in Winchester Cathedral). It is 3ft. 4in. square, sculptured on the north side with the Creation and Temptation, on the east side with the Expulsion and the Curse, and on the two other sides with arcading and an ornamental frieze; the top of the bowl is also richly sculptured. At the junction of the S. transept and the nave is a stone slab, with the cryptic inscription " Amens Plenty," which still awaits explanation.

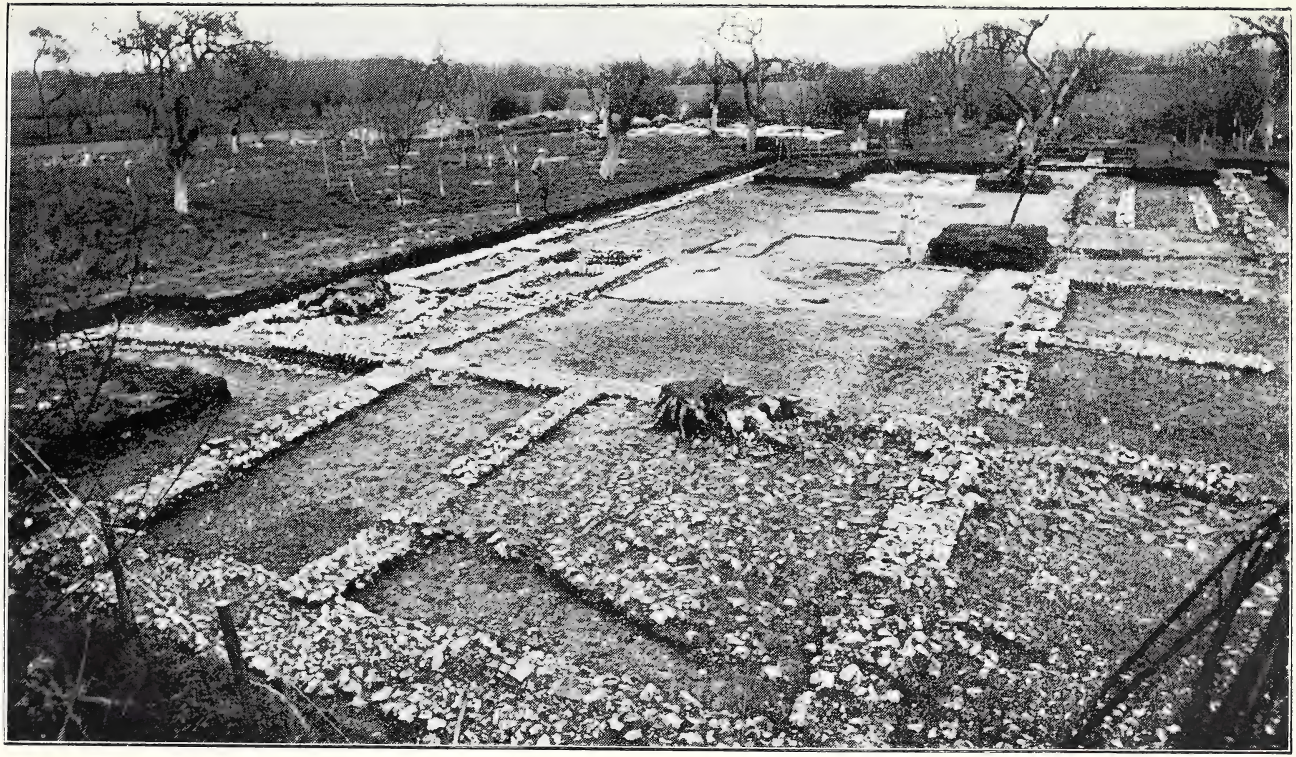
By special permission of the owner, Mr. Horder, the party was admitted to the ancient manor house, where the Bishops of Winchester were wont to hold their court. It has passed through a phase of decay as a farm-house, but is now under restoration by the owner. It contains much interesting 15th century work, notably a spacious hall with open timber roof, a splendid specimen of mediæval architecture.

On the return journey a halt was made at West Meon, where the church, entirely rebuilt in the middle of the last century, affords nothing of interest but a Jacobean altar-table, and the tomb of the founder of Lord's cricket ground.

Minley Manor. This Excursion on June 5th to the beautiful gardens of Minley Manor had been intended to include a short visit to Odiham. But a change in the programme enabled the party to inspect some most interesting Roman remains which have recently been laid bare in the neighbourhood. The following account is based upon information supplied by Messrs. Gale and Polden of Aldershot, to whose courtesy is also due the illustrative view of the site.

It appears that as far back as November 1928 Mr. Percy Parsons, of Lodge Farm, North Warnborough, in the course of planting in his orchard, had turned up sundry fragments of tile and pottery, sufficiently interesting to induce him to enlist the active co-operation of the Hampshire Field Club. The work of exploration was entrusted to Miss D. M. Liddell, F.S.A. (Scot.), and already in the spring of 1929 there had been revealed the foundations of a six-roomed house, 40 feet by 20 feet, with evidence of decorated floors and interior walls (of flint), a fine tesselated pavement, and a hypocaust with furnace, the stoke-hole with charred floor of white chalk still powdered with soot, and the whole complete with a system of flues, and tiled pillars supporting the thick concrete floor of the room above. The " finds " were, for a Roman Site, extremely scarce, but included a quantity of coarse pottery and tiles, a little Samian and finer ware, a bone counter inscribed with Roman numerals, a key with bronze ring attached, horse and mule shoes, fragments of glass, and a few coins of late 3rd and early 4th century. This site can be made out in the centre at the top of the picture.

In the following season a very considerable portion of the orchard was uncovered, to a depth of only 2 feet, with the result that the remains of a whole range of buildings, grouped about a central courtyard, have been laid bare, extending over an area of about 125 feet by 55 feet, and including a furnace and a complete system of central heating by means of flues, installed in the



Gale and Polden.

ROMAN REMAINS AT ODIHAM.

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south-west corner. In the centre of the picture was apparently the chief living room, for the hearthstone was found, much burnt, and embedded in a deep layer of fine wood ash. The floor is of beaten chalk, and near by was found a great pile of oyster shells, probably from the Emsworth or Hayling Island beds.

The work has been most skilfully carried out; every spadeful of earth has been carefully sifted and examined, with the result that a whole series of interesting " finds " has been made, including a handsome lipped pot, about 4 feet round, quite intact; an ingenious padlock—a long prong with two iron springs round it, which fitted into a tube or box, opened by a key inserted so as to press the springs close to the shank and to allow the tube to be withdrawn—; two vases jammed into the mouth of the furnace, one of these being a particularly interesting specimen of New Forest ware; a whetstone, with a smooth surface still fit to take any razor blade to-day; and a variety of articles of domestic use, pottery and glass in great profusion, a considerable number of coins, and handsome personal ornaments in silver and bronze.

It is conjectured that the house may have been the home of a prosperous Roman farmer, one side of the courtyard being, possibly, inhabited by the farm hands and the other by the owner's family; and that the building previously discovered may have been an annexe principally used as a bath house.

Lacock Abbey and Potterne. On June 18th an exceptionally attractive excursion was led by Mr. Dodshon into the heart of Wiltshire. At Tilshead " the capital of the Plain," a short time was spent in the church, transition Norman with fine chancel, clerestoried nave, 14th century south aisle (with piscina), and Norman font. Near by are interesting barrows, of which the chief (White Barrow) is 85 yards long, 52 yards wide and 8 feet high, now under the care of the National Trust.

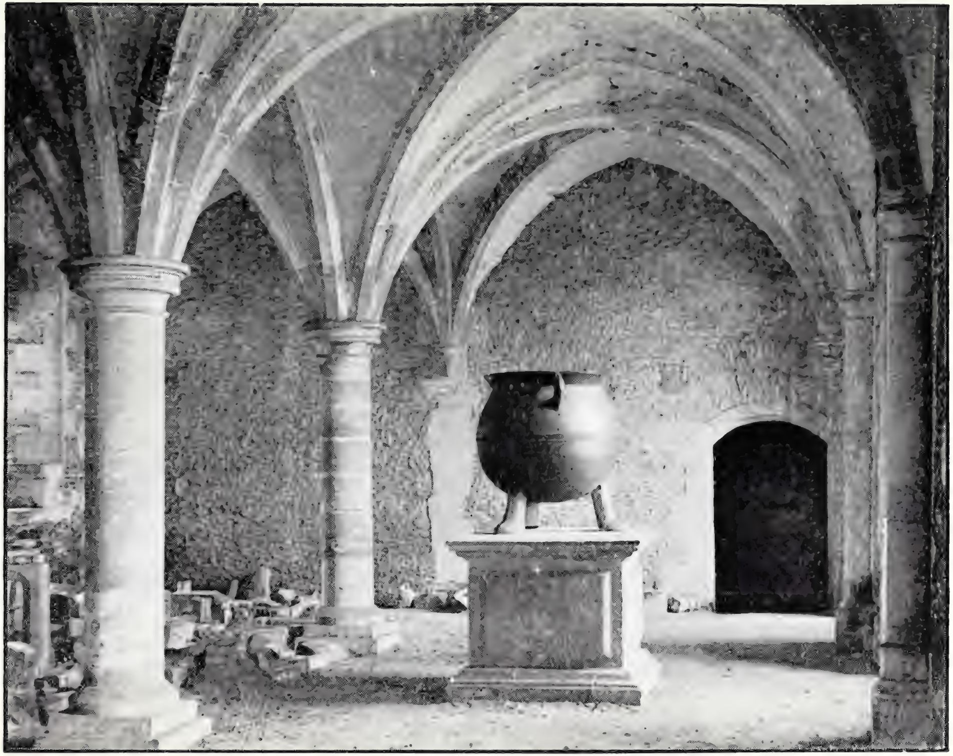
Potterne proved to contain two treasures. The Porch House is a 15th century building, carefully restored by the late George Richmond, R.A., during his tenancy. It contains a lofty dining hall with an oriel, and a tracery look-out from the chamber of dais, besides a charming garden, in which, by the kindness of Mr. Hornby, the present owner, the party was permitted to rest. The church is a splendid example of early English at its purest and best. At the west end is now installed a remarkable tub font, unearthed during restorations in 1872. Round the rim is an inscription " As the hart panteth, etc.," in Latin, not of the Vulgate, but attributed to the Saxon baptismal office. It is in an ancient script, the characters resembling those of a copy known as S. Cuthbert's Gospels, now in the British Museum, probably of the 8th century. The font perhaps belonged to an old Saxon church, which stood in the lower churchyard.

At Lacock there is another 15th century Porch House with oak panelling and a pretty garden, and in the George Inn a unique dog spit, in the form of a wooden drum some 2ft. 6in. in diameter revolving on a steel axle in a recess and worked on the treadmill principle. The village also contains a good 14th century barn, an ancient cross (restored), and numerous half-timbered and stone-built houses. It is in fact a gem among villages, and by the care and vigilance of the Talbot family absolutely free from modern " improvements " and " developments." The church is an interesting example of late English architecture, and contains a lady chapel with fan tracery and rich colouring, some fine monuments, and a brass dated 1501.

The crowning glory is the Abbey, founded by Ela, widow of William Longsword, that Earl of Salisbury whose noble effigy lies in the nave aisle of the Cathedral which together they had laboured to establish. At the Dissolution the Abbey was at first exempted on payment of a fine, the " visitors " acknowledging its good reputation with " no notable comperts " (abuses); but in 1539, the nuns, although " of vertuous lyvyng and all desiring to continue religious," were dispersed, and the property was granted to Sir William Sharington for a trifle over £780. His first step was to pull down the church, the site of which forms the present terrace walk, but the rest of the monastic buildings he spared, and incorporated in a Tudor residence, with a tower which is a splendid example of Renaissance work. The cloister walks, in an unusual position on the north side of the church, remain, with all the beauty of their delicate groining, and the richness and diversity of the bosses, still showing traces of colour.

A curious relic, known as the " Nuns' Cauldron," is a huge bronze vessel cast at Mechlin in 1500, with an estimated capacity of 67 gallons. It stands on a pedestal in a vaulted chamber of the Abbey, probably the Calefactory.

In 1574 the estate passed by marriage to the Talbot family, among whom may be mentioned Ivory Talbot, who, early in the 18th century, built the large pseudo-Gothic hall and the Palladian dining room; Sir Gilbert Talbot, who, along with Pepys, was largely instrumental in founding the Royal Society; and Fox Talbot, a 12th Wrangler and Porson Prizeman, who after a short spell of parliamentary duties turned his great abilities to scientific study, and is the acknowledged father of English photography, his discoveries being contemporaneous with, but independent of, the somewhat similar processes of Daguerre. A considerable proportion of his apparatus has been handed over to the Royal Photographic Society, but the party had the opportunity of examining all that remains in the possession of the present owner, his grand-daughter, Miss Talbot, to whose kindness our Society owes the pleasure of a memorable excursion.



THE NUNS CAULDRON. LACOCK ABBEY

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Wilton House. Though twice already visited by the Society (the last occasion was in 1922) no details have hitherto appeared in our Proceedings. The town of Wilton boasts great antiquity. It was in West Saxon days the chief seat of the Wil-saetas, from whom the county derives its name. A religious house for seculars was founded here in 773 and developed into a priory of Benedictine nuns, who were driven out at the Dissolution. Old Sarum was its rival in importance; but with the foundation of Salisbury came a diversion of the great western road, the Icknield Street, and, according to Leland, "The chaunging of this way was the total cause of the ruine of Old Saresbyri and Wiltown, for afore Wiltown had 12 paroche churches or more, and was the hedde town of Wileshir." Wilton House occupies the site of the old monastery, the estate having been bestowed by King Henry VIII on Sir William Herbert, afterwards Earl of Pembroke, and held ever since by that family. He is said to have entrusted the design of the new house to Hans Holbein, but of this only a portion of the east front survived a destructive fire. It was incorporated in a new building by Inigo Jones, who gave an Italian facade to the south front. Here is the great gallery containing the famous Vandycks, the special glory of the Wilton treasure house, besides fine specimens of Rembrandt, Rubens, Reynolds and others. The Holbein porch now serves as a garden pavilion and the beautiful Palladian bridge is attributed to Inigo Jones.

The Herberts have been staunch patrons of literature and art, and here they gave welcome to Ben Jonson, Massinger (the son of a retainer of the house), Spenser, Izaak Walton, Sir Philip Sidney, and, according to credible tradition, even Shakespeare, who is thought by some critics to have immortalised the third Earl in the mysterious "W.H." the "onlie begetter" of the sonnets. Queen Elizabeth spent three days here in 1573, during which time she presented Sir Philip Sidney with a "Locke of her owne hair," discovered in recent times in a copy of the "Arcadia" in the library.

The excursion on July 10th, conducted by Mr. Herbert Smith, gave ample time for inspection of the house and also of the park and gardens, but the magnificent new church, in the Lombardic style, erected in 1844 by the first Lord Herbert of Lea, did not come into the programme. As a compensation may be reckoned an hour or two spent in Salisbury Cathedral on the out journey.

Savernake and Marlborough. This excursion, on July 22nd, conducted by Dr. Nankivell, attracted great interest in ground not hitherto explored by the Society. The route viâ Salisbury and Tidworth led to Savernake, where the Vicar kindly put his garden at the disposal of members. Thence the way lay through the famous beech avenue, 5 miles long and over two centuries old, from which a view was to be had of Tottenham House and of many deer which still frequent the forest glades. Savernake was a Royal Forest and formed part of the jointure of Queen Eleanor, passing afterwards to the Seymours and, later, by marriage, to the Bruces. The house, now the seat of the Marquis of Aylesbury, stands on the site of the ancient palace of the Seymours, but offers no special attraction. From the fringe of the forest a rapid descent brought the party to Marlborough, where, by permission of the Headmaster, the afternoon was spent in the College, particular attention being given to the Chapel, the Museum, and the War Memorial Hall. The return journey was a delightful drive by way of Pewsey and Amesbury.

S. Catherine's Hill, Winchester; Longstock and Danebury. Three ancient Camps were visited on August 12th, and the significance of each was clearly expounded by Dr. Williams-Freeman. S. Catherine's Hill has lately been acquired by Winchester College, and its archæological interest safeguarded for all time. The origin and purpose of the Maze, like that at Breamore, is involved in obscurity; but recent excavations, begun by three Wykehamists, assisted, later, by the Hants Field Club, have revealed an extraordinary amount of information, which may be found in a work published by Warren, of Winchester. The Camp, embracing an area of about 18 acres, was defended by a single bank and ditch, together with, at places, a slight bank on the counterscarp side. Across the neck of land connecting the site with the main ridge of the downs the rampart was higher, the ditch deeper than elsewhere, some 25 feet in all. Some pits, of which 13 have been opened, are visible here and there. Two of these had hearths and floors, one showed traces of wattle, one clearly was a rubbish pit, the rest, perhaps, store pits. The hill was occupied for four centuries, from late Hallstadt to middle la Tène, say from 500 B.C. to 150 B.C. The first entrenchment dates from late la Tène I. or early la Tène II. —say, 350 B.C. to 300 B.C.—as also the causeway, 40ft. broad; the ends of the ramparts were faced with clay, revetted with horizontal beams secured by vertical posts. To bar ingress, there were two or more central door posts, from which hung gates, which shut back on stoppers in the revetment. Also timber guardhouses were erected, oblong in shape, roofed, and cutting into the sides of the ramparts. Succeeding periods of peace and warfare were marked by decay and renewal of the defences, until (in la Tène II.) the final destruction by fire, so intense as to convert the clay into red powder; chalk, even behind the revetment, was burnt grey; beams of wood were reduced to charcoal and ash.

Driving up the Test valley, the party reached Longstock, reputed to have been the advanced base of Canute and his refuge after defeat by Edmund Ironside at the battle of Seorstan. Here was the Danish dock, measuring 130 yards by 30 yards, connected with the Test, by a short arm at its south end, by one of 180 yards at the north, and protected by a fortified camp, encircling it and concealing it behind a raised bank. The whole served as a strong position to cover the neighbouring ford. High above the valley rises Danebury Hill with its ancient camp, the huge proportions obscured by recent growth of timber, the inner vallum embracing an area of 18 acres, and the whole bearing a close resemblance in form and construction to Weatherby Castle, visited by the Society in June.

Arundel Castle. This very distant excursion, organised and carried out on August 18th by Mr. Dodshon, was fully justified by the support of over 100 members, and certainly no more interesting and magnificent pile could be found in the South of England, perhaps with the solitary exception of Windsor. It is the proudest possession of the Duke of Norfolk, and it is not a little curious that since its original bestowal on Roger de Montgomery, commander of the Bretons at Hastings, it has changed hands only three times and always through a female branch. It first came to William de Albini, Earl of Sussex, as a dowry with Adeliza, widow of Henry I, who had besieged and captured it in 1102; later in 1247 to John Fitz-Alan, on his marriage to Isabel, the sister of Hugh, the last Earl; and finally in 1580 to Thomas Howard, fourth Duke of Norfolk, who married Mary, the only daughter of the last Earl of the Fitz-Alan line.

The Castle itself has suffered corresponding changes, declining in the 13th century; developing in the 14th under Richard Fitz-Alan, who raised it to the front rank of military strongholds; besieged by Waller in 1643 in the Civil War, bombarded and (on the south and west sides) reduced to ruins. A century and a half later the work of restoration began, notably the Gate House and adjacent walls, and was brought to its present noble condition by the late (15th) Duke of Norfolk.

In the Parish Church of S. Nicholas the party was met by the Vicar, who pointed out, among interesting features, the iron grille in front of the blocked chancel arch, beyond which lies the famous Fitz-Alan chapel, constructed in 1380 to serve a College, for a Master and twelve secular canons, which replaced a Benedictine Priory established here in 1094. This chapel is the property of the Duke of Norfolk and contains six Fitz-Alan tombs, among which that on the south side, of fine Purbeck marble, has been pronounced the finest mediæval chantry tomb in England. There are no monuments to the Howards, though many of them are here interred, among them Thomas, 24th Earl of Arundel (1646), the collector of the Arundelian marbles.

The modern castle is a reconstruction on a grand scale of the ancient pile, the whole, including the courtyard and the tiltingyard, embracing within the ramparts an area of 5½ acres. Above all towers the Norman Keep on a mound 76ft. high, the most ancient part of the castle, besieged by King Stephen in 1139.

The state apartments are enriched with artistic treasures—furniture, tapestries, and pictures by Vandyke, Holbein, Lawrence, Gainsborough and others—and include a stately library 120 feet by 24 feet, and a dining room on the site of the ancient family chapel.

Mottisfont Abbey. On August 29th the Society's acquaintance with Hampshire was enlarged by an exploration of the Test Valley under the guidance of Mr. S. Whitaker.

North Baddesley, lying 3 miles east of Romsey, became, by transference from Godsfield after the Black Death of 1349, the headquarters of the Hampshire preceptory of the Knights of the Order of S. John of Jerusalem. The extensive buildings were burnt down about the middle of the 18th century, but the kitchen is incorporated in the present manor-house, now occupied by the Rector, who has done excellent work in setting the Church in order. It dates from the 15th century, though the screen and pulpit are Jacobean, and contains a chained Bible of 1611 and a raised tomb with panel shields showing the Hospitallers' Cross. An earlier church is mentioned in Domesday Book.

The party drove on to Mottisfont Abbey where, by special permission of the owner, they were admitted to the ground floor, which incorporates part of the Chapter House and cloisters. This was the seat of a priory of Augustinian Canons, founded by William Brywere about 1200. After many vicissitudes it fell to Lord Sandys, the King's Chamberlain, at the Dissolution, and it has passed by direct descent to its present owner, Mrs. Barker Mill, reconstructions and additions having brought it to its present condition in the 18th century.

The adjacent church of S. Andrew is largely 12th century work, notably the chancel arch with two moulded orders, enriched with zig-zags and in excellent preservation, and a square font of Purbeck marble. The east window is completely filled with 15th century white and gold glass; the figures are well drawn and the colouring fine.

Proceeding up the broad valley of the Test the party reached King's Somborne, where the church suffered severe "restoration" in 1886, but still contains much of interest, an early 13th century octagonal font of Purbeck marble, good Jacobean altar rails, a couple of brasses, and, in a 14th century recess in the south wall of the chancel, the effigy of a priest in eucharistic vestments with an inscription in Lombardic capitals. Notable also are masons' crosses and monograms on the jambs of the north doorway and three "scratch-dials" on the external south wall.

At Little Somborne the party found a remote little church, consisting merely of a nave; the chancel arch is built up at the east end, above it are two small lancets, transferred from the former chancel. South of the arch is a much smaller light of Saxon date, and to the same period is attributed the west end, as well as " long and short " work at the north-west angle and a pilaster strip against the north wall.

On the return journey a long halt was allowed at Romsey, the Abbey affording once more abundant interest.

Report of the Delegates to the Meeting of the British Association at Bristol

Bristol entertained the Association for the fourth time in its history, and offered excellent accommodation in the University buildings.

The two meetings of Delegates were mainly concerned with the question of National Parks, which formed the subject of the Address of the President, Professor Patrick Abercrombie. Three points were stressed: the preservation of the natural scenery, which would not preclude some thinning out of woodlands; the conservation of fauna and flora, which might necessitate the exclusion of the public from certain areas; and the utilization of the Park as a place of recreation. "We are waiting for the Report of the National Parks Committee," said the President, and in the meanwhile various areas have been suggested as suitable for reservation:—The whole line of the Roman wall from Chesters to Gilsland, advocated by Dr. Vaughan Cornish; Cannock Chase, remarkable for the diversity of its scenery and the richness of its Flora and Fauna, and already under the careful observation of a local committee; the Forest of Dean, and others. Finally, a Resolution was passed, strengthening the hands of the Council of the British Association in their dealings with the Government in the matter of Natural Reserves and in the whole question of National Parks.

The question of Folk Museums was raised by Miss G. V. Barnard, who, with the help of lantern slides, described the Strangers' Hall at Norwich, apparently the only Museum of the kind in this country.

Dr. Ashford spoke on "Smoke Abatement," and asked for Reports on the operation of the ultra-violet rays during the working days in our manufacturing towns.

Some discussion took place on the advantages of co-operation between Scientific Societies.

Claude Lyon,
John Williams,

Report of the Botanical Section.

The Botanical Section held 30 meetings, comprising 9 afternoon lectures and discussions, one "At Home," and 20 excursions. The particulars are given in the Council's Report.

The Wild Flower exhibit in the Lansdowne Public Library, from March to October, continues to attract interest among visitors and residents, many bringing specimens for identification. Students gladly avail themselves of its educational help. The work is superintended by the Misses Rooke, S. Wetherell, and M. A. Parton, and Mr. H. J. Wadlow.

Notes on Plants of the Bournemouth District, 1930.

By L. Beeching Hall, F.L.S.

Nasturtium sylvestre *R.Br.* This plant is not mentioned in Linton's "Flora of Bournemouth." In 1927 I found it at Christchurch; this year it was growing near Ringwood, and Miss Fryer discovered it near the bowling green in Meyrick Park. It is regarded as a native species, but in these three local stations, as frequently elsewhere, it occurs as a weed in disturbed or garden ground.

Stellaria Boræana *Jord.* This species is mentioned by Linton as a variety of S. media (Chickweed), and he gives five stations in the district. This year there was a number of plants near Brand's Bay, Poole Harbour, which is a new locality. It is usually probably overlooked owing to its resemblance to S. media, but differs in having no petals, only three stamens, and in its prostrate habit.

Vicia bithynica *Linn.* This plant was recorded in the 1874 Edition of the "Flora of Dorset" as occurring "In Purbeck, Hudson." In Linton's Flora it is referred to as "? existent . . . . no recent record." This year there was a small but well grown colony of this uncommon plant near Poole, which reinstates it as one of our most interesting local species. Compared with those growing near the Lizard Head, the flowers of these plants differed in having the wings a decidedly duller tone, suffused with purple, making them less conspicuous.

Senecio vulgaris *Linn.* var. radiatus *Koch.* This variety of the Grounsel has small but conspicuous ray florets, which give it a superficial resemblance to S. sylvaticus, from which however it may be readily distinguished by the more numerous outer bracts, each tipped with black, and much larger in proportion to the inner bracts than in sylvaticus, and by the seeds, which are brown or grey, and not black, when ripe. This distinct variety has been in flower in the centre of Bournemouth from May to October this year. It is not mentioned in Linton's Flora, and appears to be a new record for the district.

Scorzonera humilis *Linn.* The two East Dorset localities for this plant still remain the only British stations reported. (See B.N.S.S. Proc. 1927-8, p. 61). This year the colony in the original station had increased in numbers and flowered very freely. Several small clumps were noted in a new area a short distance to the north of the original area, and to the south a single plant was found in flower about a quarter of a mile beyond the limit hitherto noted. This plant was growing among the heather. It will be interesting to see if it survives under the competition of its new surroundings.

Erica ciliaris *Linn.* It was particuarly interesting to find, for the first time, the Dorset Heath growing on Studland Heath. As far as I know it has not previously been reported there. This is a considerable extension of its well known range.

Verbascum Blattaraia *Linn.* (The Moth Mullein.) This plant is recorded in Linton's Flora from three localities only, Ashley Common, Swanage, and Christchurch. This year it appeared on waste ground in Meyrick Park, Bournemouth, which is a new division of the district, making four in all. This plant had the petals yellowish-white, tinged with pink. The normal colour is yellow.

Plantago Cynops *Linn.* This interesting branched Plantain was found this year for the first time in the district by Mr. Wadlow, on waste ground at Parkstone, where several plants were growing. The earliest record of its occurrence in Britain appears to be in 1902, in Kent. Mr. H. N. Ridley tells me that he considers it native in that county, but Dr. Druce considers it adventive. There is no doubt that in the Parkstone station it was introduced with ballast. This area has been carefully searched during the past few years and it is almost certain that the species appeared there this year for the first time. It grows in the South of France, Spain, Italy, Switzerland and Austria.

Illecebrum verticillatum *Linn.* Notes on this plant were given in the B.N.S.S. Proceedings 1927-8 P. 62. It still persists in the original enclosure in the New Forest, but this year the quantity was much reduced compared with the two previous years.

This year numerous plants were growing in a very limited area between Lyndhurst and Beaulieu. As far as I know this station has not previously been recorded. As in the other New Forest station, the plants grew only where the ground had been recently disturbed. I think that this species cannot be regarded as native in the Forest.

With regard to the duration of this plant, the authors of various Floras are not in agreement. Of 11 to which I have referred 4 give it as annual, one annual or biennial, 4 as perennial, and 2 do not mention the duration. In order to determine this point I have grown it for the last five years, under varying conditions, and find that while the great majority die during the first winter, a very few survive until the spring, but do not last into the second summer. The plants growing in the New Forest behave in the same way.

None of the plants I have grown from seed has failed to flower during the first year, so cannot be classed as biennial, but they are so described by Corbière in his "Nouvelle Flore de Normandie." Whatever may be their duration elsewhere, in this district they may be described as annual, sometimes lasting until the following spring.

Avena strigosa *Schreb.* (The Black Oat.) This plant is given in Linton's Flora as a rare casual, with records for two divisions within the 12 mile radius. For some years past there have been no records, but this year I found it near the Isolation Hospital at Poole, and at Ringwood. The latter is a new divisional record. This plant is probably much more common than the few records suggest. It is easily passed for the common oat, but is usually distinguishable at sight by the one-sided panicle and more slender spikelets, which never open widely as in the common species.

The most notable difference is in the lower pale; in strigosa this has two long rough apical bristles, which in the common oat are represented by two short points.

Poa compressa *Linn.* This grass, although not very common, is widely spread over the country, and is recorded for about 75 of the 112 Watsonian divisions. In the Bournemouth district it is very rare. The only localities mentioned by Linton are Langton Matravers and Swanage. This year I found several well grown clumps in Meyrick Park, which is a new station. It is probably sometimes passed over as a small form of P. pratensis, but the much longer ligule of that species is an easily observed difference. From compact forms of P. nemoralis it is readily distinguished by its much more abruptly pointed leaves. From both it differs in the much compressed stem.

Bromus britannicus. *I. A. Williams.* This grass was described by its author in the Journal of Botany for March 1929 as a species new to Science. A short account of it was given in the B.N.S.S. Proceedings for 1928-9, P. 53. During this summer I have found it in four places in Dorset; near Stourpaine, Blandford, Wool and Poole. It has been found in various districts throughout the country.

In the middle of August, 1929, I sowed three batches of seed from Hampshire specimens; some in almost pure sand in full sun; some in sandy peat in full sun, and the remainder in sandy peat in shade. All the seedlings were about 1¼in. high a week after sowing, and by the end of September the tufts were about 4 inches high and remained so throughout the winter. By the middle of June they were in full flower and many bore ripe seeds during the first week in July. The examination of a large number of these showed that all the distinguishing features remained constant. The only effect of the variation in situation was that the plants in the sandy peat in full sun bore much larger panicles with more numerous spikelets. The plants from the four stations mentioned above all showed the special characters very distinctly.

From the nature of these distinguishing characters, and from the above evidence, I think that this plant may well be regarded as a satisfactory and distinct species. Specimens of the cultivated plants have been placed in the Society's herbarium, and sent to Kew and South Kensington.

Entomological Section.

The first general meeting was held on the 21st November, when the Chairman read a paper describing the life history of the Comma butterfly, Polygonia c-album (Linné). He called attention to the numerous letters and notes which have during the year been published in the public press and in entomological journals of the occurrence of this butterfly in many localities east of and far distant from the area, comprising the counties of Hereford, Worcester and Monmouth, which writers give as containing its principal haunts in England. He gave extracts taken from the works of numerous authors which tended to show that in the 19th century this butterfly was very generally distributed, but that during the 30 or 40 years prior to 1914 it had disappeared from many counties where it was formerly plentiful. Records taken from the " Entomologist " from 1922 onwards showed a spread into many counties, including Hampshire, where amongst many localities specimens were observed in the Bournemouth Pleasure Gardens and elsewhere in the County Borough.

The causes of periodical appearance and disappearance were then discussed, such as climatic conditions during hibernation and at the time of the emergence in April of larvæ from the ova of hibernated females, the attacks of hymenoptera on the larvæ and of birds on the pupae, and the migratory impulses which affect some species.

Specimens of the first and second broods including the variety or partial first brood form known as *hutchinsoni* were exhibited.

On the 16th January a paper by Dr. Crallan on the family Sphingidœ or hawkmoths was read by the Chairman in the absence of the author through indisposition. Descriptions were given of the habits and characteristics from ovum to imago of each British species and the paper was illustrated by the exhibition of specimens contained in the collection presented by Dr. Crallan to the Society.

At the meeting held 20th February a paper was read by the Chairman on Sirex gigas—the timber sawfly—which is the largest

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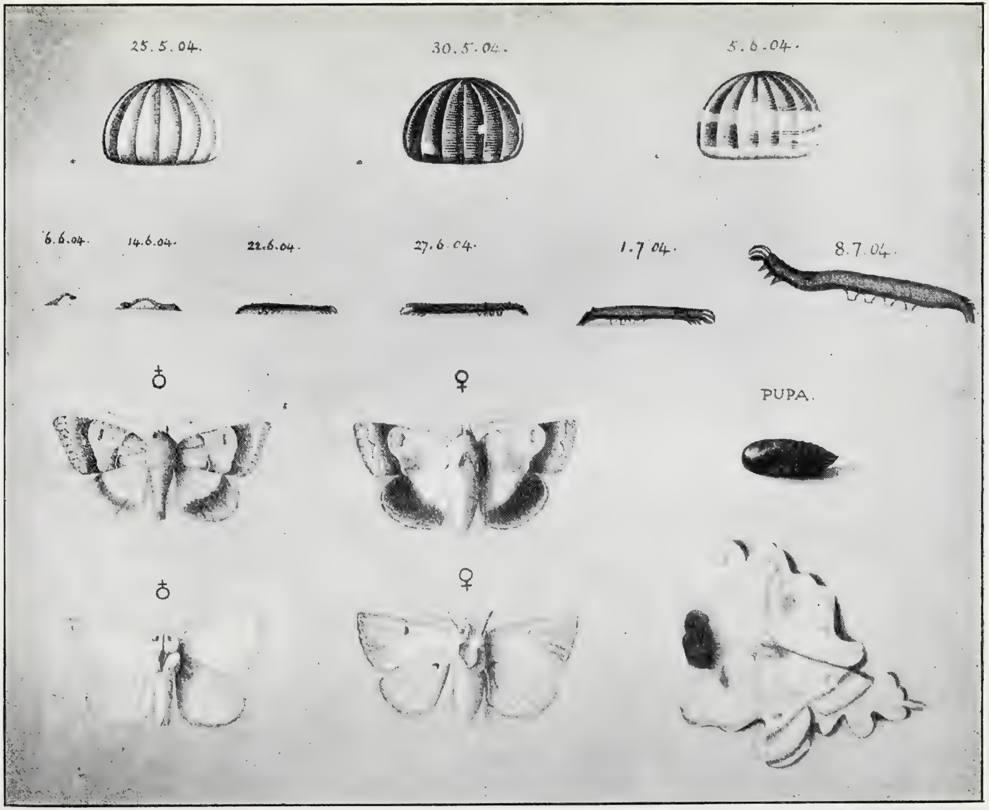
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OPHIODES LUNARIS

species of the order Hymenoptera found in England. It also occurs fairly commonly in Ireland. Specimens of the male are rarely observed, but the female is not of uncommon occurrence. She is of conspicuous black and yellow colouration and is provided with a long, slender, rigid instrument, which proceeds from the underside and not from the apex of the abdomen. This is some 23 mms. in length, and by means of it she is able, in as effective a manner as with an archimedean drill, to pierce the wood of timber both standing and felled, for the purpose of depositing her ova therein. She shows a preference for sickly silver fir (Picea pectinata), and the resulting larvæ make mines in the timber, causing damage from a commercial point of view. The paper was illustrated by specimens of the female captured by the writer in Ireland.

On the 20th March Dr. Crallan read a paper, illustrated by specimens reared by him from continental ova and by his own water colour drawings, on the life history of Ophiodes lunaris, a species of moth common in South Europe but of very rare occurrence in England. He gave descriptions of the larva in its different stages of growth, and called attention to its remarkable resemblance both in appearance and attitude to a small snake. This resemblance gives rise to the generic name of Ophiodes.

In the Plate the eggs are shown magnified about 40 diameters, the other objects half life-size.

Many interesting exhibits were made at the meetings by members of the section. Mr. Beeching Hall exhibited living larvæ of the common Ant-lion (Myrmeleon formicarius) and of the Giant Ant-lion (Acanthaclysis occitannica) sent him from the south of France. He described the methods by which the larva of the former traps its prey of ants by making a conical cavity in the sand, at the bottom of which it lies concealed with its formidable mandibles widely extended and ready to seize whatever may slip into the pit.

Surgeon-Captain G. G. Borrett, R.N., exhibited specimens of the snouted grasshopper (Truxalis) and other insects taken by himself when in Queensland and Fiji, and preserved in solution.

Mr. Webber showed many interesting specimens of butterflies and moths taken during the summer of 1929, including Thecla betulœ, Lycœna icarus and Angerona prunaria; also a specimen of the locust (Acridium peregrinum), a native of North Africa, taken by him on a gate post in Boscombe.

Report of the Zoological Section.

Summary of Observations on Birds from October 1929 to October 1930.

From the Rev. F. C. R. Jourdain.

Crossbill (*Loxia c. curvirostra*). These birds have been present in the Southbourne district in fair numbers throughout the year. On August 17th, 1930, considerable numbers were noticed at North Stoneham (near Southampton) and these may have been immigrants.

Grey Wagtail (*Motacilla c. cinerea*). A few pairs breed in the Stour and Avon valleys in suitable localities, such as on the R. Avon near Ibsley. Mr. C. E. Tucker informs me that he saw a male feeding young near Heron Court in 1927. In Dorset, Captain J. S. Reeve found a pair breeding in June, 1930, on the river Frome near Wool.

Dartford Warbler (*Sylvia u. dartfordiensis*). These birds were present in about normal numbers and apparently had not suffered from the winter.

Cuckoo (*Cuculus c. canorus*). On June 25th, 1930, I saw a Corn Bunting's nest on a heath in East Dorset with three eggs and one of the Cuckoo. This is one of the scarce fosterers, and Mr. E. Chance suggests that this Cuckoo was probably normally parasitic on the Meadow Pipit. Another Cuckoo's egg was found in the same district on May 21st in a nest of Dartford Warbler with three eggs. This is an even rarer host than the Corn Bunting. One Cuckoo was apparently reared by a Blackbird in 1930 and was frequently seen to be fed by its foster parent.

Merlin (*Falco c. æsalon*). Mr. M. Portal reports a hen Merlin trapped near Whitchurch in May, 1930.

Osprey (*Pandion h. haliaetus*). Mr. M. Portal writes that an Osprey visited the river Test at Laverstoke Park in August, 1929. It stayed for a day and a half and then left and was seen to strike the water with a splash when fishing.

Glossy Ibis (*Plegadis f. falcinellus*). One was shot in the Christchurch marshes on October 26th, 1929, and is recorded and figured by F. W. Frohawk in the *Field,* 27th September, 1930, p. 444.

Turtle Dove (*Streptopelia t. turtur*). Two birds were in my garden at Southbourne on October 18th, 1930; a very late date for this species.

Garganey (*Anas querquedula*). This bird bred again in the Weymouth district in 1930 and a nest with eggs was found there (*Br. Birds,* xxiv, p. 82). The Tufted Duck (*Nyroca fuligula*) also bred in the Weymouth district in 1930 (*loc. cit.*).

Gannet (*Sula bassana*). One of Miss C. Popham's girl guides picked up an adult bird which had been " oiled," on the beach at Southbourne, on January 14th, 1930.

Kentish Plover (*Charadrius a. alexandrinus*). Dr. A. C. Coles reports two birds, which from their black feet must have belonged to this species, on the mud flats at Mudeford, with Ringed Plovers, on September 5th and 11th, 1930.

Green Sandpiper (*Tringa ochropus*). Mr. B. J. Ringrose saw one on the west side of the New Forest on July 1st and two more on July 12th, 1930: early dates for the appearance of this species.

Lesser Tern (*Sterna a. albifrons*). It is satisfactory to hear that there was a flourishing little colony on the Hampshire coast in May, 1930.

Spotted Crake (*Porzana porzana*). One of these birds was present for some weeks on the heaths of East Dorset and West Hants in May, 1930, and its peculiar clicking note was frequently heard, but owing to the density of the covert no nest was found and it is not known with certainty whether it bred here or not.

FROM MISS DOROTHY COOKE.

A list of 96 species identified during the past year within our area and the neighbouring sea, together with an additional three species (which, though not identified, are probably correct) bringing her list to 99.

FROM MR. H. J. WADLOW.

In an oak tree in the garden at Parkstone a Tree Creeper was seen from February 13th to March 30th; and a Lesser Spotted Woodpecker on March 21st, and from March 25th to April 7th.

My own notes are as follows:—

Crossbills (*Loxia curvirostra*) were first noticed here this year on February 26th. A pair started building in a fir tree in our garden on March 30th. Unfortunately this nest was not completed; but the birds evidently nested not far away, as they were constantly coming to our bird-bath to drink, and were seen off and on throughout the summer. On August 8th our garden was visited by numbers of them, many in brilliant red-pink plumage. These very bright-coloured birds were seen for about a fortnight, and since then our garden has been visited by larger or smaller numbers, the last being seen on October 24th.

The summer migrants arrived normally. The first Chiff-Chaff (*Phylloscopus c. collybita*), however, was not seen till April 6th.

Wheatear (*Œnanthe œ. œnanthe*) March 22nd.
Sand Martin (*Riparia r. riparia*) March 30th.
Blackcap (*Sylvia a. atricapilla*) April 8th.
Swallow (*Hirundo r. rustica*) April 8th.
Willow Wren (*Phylloscopus t. trochilus*) April 10th.
Swift (*Micropus a. apus*) April 23rd.
Cuckoo (*Cuculus c. canorus*) April 26th.

I heard a Corncrake (*Crex crex*) near Hurn Bridge on May 9th.

So far as I know the Greater Spotted Woodpeckers (*Dryobates m. major*) did not hatch out in St. Peter's Churchyard this year, though they excavated a hole in a birch tree.

On July 31st a Lesser Redpole (*Acanthis linaria cabaret*) followed by a youngster (whose feathers were not fully grown) flew over our garden.

I have had no report of the presence of Woodlarks (*Lullula a. arborea*) within the borough boundary this year.

F.G.P.

Conchological Note

"The Distribution of the Slipper-Limpet (*Crepidula fornicata*, L.) in Britain."

By E. St. John Burton, F.L.S., F.G.S.

In the December number of "The Country Side" (Vol. vi., 1907) appeared an article by J. E. Cooper on immigrant Shellfish. The North American "Crow-oyster," or more correctly, "Slipper-limpet," now becoming a familiar object on our local shores, was noticed, perhaps for the first time in a living state in the British Isles, at Cleethorpes in 1888, on American oysters. This was followed in 1893 by the establishment of the mollusc at Burnham-on-Crouch, where it may have been introduced perhaps twenty years earlier, as Mr. Cooper points out, though its scarcity at the time may have caused it to escape notice. The suggestion was confidently made that this American marine species first came over attached to American oysters, and as often happens with regard to introduced species whether plant or animal, providing that conditions are favourable for subsistence, an extraordinary increase in numbers took place within a comparatively short period of time. Our own district provides a notable instance in respect of *Crepidula fornicata* (L.). A fact that strikes the observer as remarkable is that *Crepidula* has extended its range of late years farther and farther westward. It has been known for many years in Essex, and later appeared in Sussex. It was noticed in the Solent some years before 1920, and has become firmly established along the coast near Christchurch, it being very common in Christchurch Bay and Bournemouth Bay, and also occurring further westward in Studland Bay. The later records are from Dorset. (Burton : "Marine Mollusca at Hengistbury Head and Cliff End," Journal of Conchology, Vol. 19, No. 2, 1930).

The writer has recently (1930) noticed dead shells of the species at Swanage. This would point to the fact of its probable distribution still farther down the south coast. The prevailing drift of material along the coast, at any rate in comparatively shallow water, is generally from west to east: it is therefore rather remarkable that the shells of *Crepidula* are progressing, as it were, against the elements.

This species has a partiality for mussel-beds, which are to be found at various points, especially at Hengistbury Head and in Bournemouth Bay. *Mytilus edulis* (L.), the common mussel, is detached by stormy seas, and sometimes cast up on shore in large numbers. A good number must be drifted along the sea-floor, and as *Crepidula fornicata* adheres with great firmness to the shells of *Mytilus,* distribution may be assisted by such means.

Crepidulæ adhere to a mussel in groups of as many as a half-dozen individuals at one time, the juvenile specimens being on top and on the surface of those more mature; whole families seem to exist in this manner.

The food problem naturally arises. *Patella vulgata* (L.), the common limpet, was credited by so early an observer as Aristotle with leaving its position on the rocks in order to feed. The shells of *Patella* are known to fit very precisely the slight depressions caused by the suction of the shell, and as they are believed to quit their respective homes at high-tide to search for nutriment, returning to exactly the same spot as the tide becomes lower, these extraordinary molluscs must possess the ability of distinguishing their own particular cavities, or else the shells would not fit these.

Crepidula adheres to stones, oysters, and mussels with great tenacity, and is not easily detached without fracturing the shell. Both species are considered to be phytophagous in habit, but in the case of *Crepidula* it is hard to believe that each individual, large and small, having effected its release, returns in due order and places itself upon another specimen of its kind accurately fitting the same mussel-shell. If it did not do sc, there would be a constant interchange of positions, whereas, as already stated, each shell precisely fits, one upon the other, exactly following the convexity of the upper surface. The feeding propensities of the mollusca are not as yet properly understood, and erroneous views have sometimes been published respecting the form of their nutriment. Gwyn Jeffreys, an acknowledged conchological authority, states (Brit. Conch., Vol. iii, 1865, p. 232) that *Patella* feeds on encrusting *Melobesia polymorpha* at low-water. The curious and beautiful vermiform tracings left by the *radula* of *Patella vulgata* upon flat clay clearly demonstrate its more active habits during high-tide, but assuredly it does not travel very far, because individual specimens would doubtless lose their appropriate cavities.

That the presence of large numbers of *Crepidulæ* in oyster-beds, etc., is partly on account of their search for food seems fairly obvious. They may derive sustenance from confervoid growths or even from the epidermal coat of the mussels.

If the diet of both *Crepidula* and *Patella* is restricted to the consumption of particular seaweeds, they must be infrequent feeders, considering the awkward habitats, precluding facility of movement, often taken up by them. This suggests that their food might be in part derived from microscopic organisms in the sea-water.

Royal Meteorological Society.

Phenological Observations.

The above Society would be glad to receive from members of the Bournemouth Natural Science Society Reports of the first appearance of migratory birds, insects, etc., also dates of the flowering of different plants in the district.

Library Report.

It is to be hoped that the present arrangement of the books in the Library meets with the approval of the members. The monthly and other publications are now placed on a table for reference as soon as they are received, and remain there until the receipt of the next numbers, when they are available for circulation.

During the winter months, it is proposed to resume the warming of the Library every Monday, Wednesday, and Friday. Two comfortable armchairs were very kindly presented by the late Dr. Hurry and Mrs. Hurry, and this gift has been much appreciated.

The Hon. Librarian is pleased to record the increasing use that is being made of the Library. He will be glad to have any suggestions for making it still more useful.

Many valuable books have been presented to the Library: also weekly, monthly and quarterly publications. The following is a list of the donors:—

Mr. H. Backhouse.
Mr. H. Bury.
Dr. G. E. J. Crallan.
Mrs. Fowler
Mr. Radclyffe Hall.
Mrs. Linton.
Mr. F. W. Longbottom.
Lady Mott.
Mr. W. J. Woodhouse
Miss de Paiva.
Dr. F. G. Penrose.
Miss F. Penrose.
Dr. M. C. Potter.
Mrs. Rothwell.
Dr. Dukinfield Scott.
Dr. W. A. Shann.
Mr. F. B. Taylor.

The following works were purchased :—

Civilization in Britain, Dr. T. F. G. Dexter.
The Sacred Stone, Dr. T. F. G. Dexter.
Typical Flies, Series III, Miss E. K. Pearce.
Curiosities of Natural History, 4 vols., Frank Buckland.
Life of Frank Buckland, George Bompas.
Text-book of Botany, E. Strasburger.
Structural Botany, Dr. Dukinfield Scott.
Mosses and Ferns, D. H. Campbell.
Physiology of Plants, F. Darwin and E. H. Acton.
Types of British Vegetation, A. G. Tansley.
Text-book of Botany, J. M. Lowson.
Practical Physiology of Plants, Sir F. Keeble.
Practical Botany, Dr. Bower and Gwynne Vaughan.
Manual of Botany, J. H. Balfour.
Text-book of Physics, 2 vols., J. H. Poynting.
Qualitative Chemical Analysis, F. M. Perkins.
Heat, Light, and Sound, D. E. Jones.
Experimental Chemistry, W. Briggs.
Apes and Man, H. Peake and H. Fleure.
Hunters and Artists, H. Peake and H. Fleure.
Heredity in Livestock, C. Wriedt.

Museum Report.

In spite of many invitations to inspect the Museum and the fact that it is always open to members, the number of people who use it for serious study is very small. Most of our members seem to be quite unaware of the fine collections we already possess and of the others which we are trying gradually to build up. On "Club Day" there will always be someone in attendance to answer questions and to give any information required; this affords the best opportunity for seeing the Museum both with enjoyment and profit. We already possess practically complete collections of British butterflies and moths, birds' eggs, dried plants and shells, large collections of birds and birds' skins, fossils from the Barton beds, leaf impressions from the Bournemouth beds, and local geological specimens. In the Archæological Room upstairs there is a small but valuable collection of Egyptian antiquities, flint implements found locally, and very fine illustrations of New Forest pottery.

Several interesting additions have been made during the past year. Mr. A. Gray has presented us with models of the edible British Fungi which are specially interesting owing to the number of deaths which have lately occurred from poisonous Fungi being mistaken for mushrooms; so attractive has this exhibit proved that the Committee hope to add models of the poisonous fungi which are likely to be mistaken for edible ones.

Thanks to the kindness of Dr. Crallan, we shall shortly have a practically complete collection of minerals available for study. Several students have written during last year to inquire if we had a collection of minerals which they could consult; Dr. Crallan's cabinet will therefore be most useful in replacing our previous very scrappy collection.

Lieut. H. V. Ewbank has very kindly presented us with two cabinets of Lepidoptera, including a large collection of Indian butterflies. Though these are somewhat outside the scope of our Museum at present, we felt that the collection was too valuable to refuse, and it is proving of great interest to the Entomological Section.

Mr. J. H. Scott has presented a " Sarsen Stone," or " Gray Wether " as they are often called locally, which has been placed at the corner of the Drive leading to the Lecture Hall. This stone was found in Ensbury Park. They occur most commonly in Wiltshire and Somerset, and are pronounced to be the more compact portions of once continuous deposits of Tertiary strata that were spread over the areas where they occur, but which have now been removed and destroyed by denudation. The first name for these curious stones is derived from an old popular notion that they were scattered in their present situations by the Ancient Saracens; the second name has reference to their curious resemblance, when seen from a distance, to a flock of sheep.

Mr. E. St. John Burton's gift of a cabinet and collection of British Land and Fresh-water Shells is most welcome and fills up a gap in our collections. It is hoped that during next summer it will be possible to arrange some conchological excursions to introduce some of our members to the delights of snail hunting.

Captain Borrett is most kindly working at the formation of a collection of reptiles and larvae preserved in formalin; it will be a very welcome addition to the Museum.

The gifts of stuffed birds from the Salisbury Museum and from Mrs. Tisdall add valuable specimens to our collection, which has grown enormously during the last three years.

The Curator would welcome the assistance of any member who could help in classifying the geological collection or leaf impressions from the Bournemouth beds.

A list of donations to the Museum is appended:—

Surg.-Capt. G. G. Borrett, R.N.; Preserved Reptiles and larvae.

E. St. John Burton: Cabinet and Collection of British Land and Fresh-water Shells and other shells. Also Fossils from the London Clay.

H. Bury : Microscopical Slides.

Lieut. H. V. Ewbank : Two cabinets and collection of Lepidoptera, largely Indian butterflies.

A. Gray : Models of British edible Fungi.

Miss Moss : Marine specimens, etc.

Miss M. Preston : A collection of dried Ferns.

Salisbury Museum : Six cases of stuffed birds.

J. H. Scott : Sarsen Stone found in Ensbury Park.

Mrs. Tisdall : Four cases of Australian birds.

Miss Marcia Penrose : Specimens illustrating the manufacture of Rayon.

Presidential Address.

The Geographical Distribution of Land Animals.

By Henry Bury, F.L.S., F.G.S.

No one can make a close study of the animals and plants of different countries without meeting with numerous cases in which nearly allied genera and species are separated by wide stretches of ocean, and without wondering how this " discontinuous distribution " can have arisen. Let us take a few conspicuous instances.

(1) Tapirs are found in South and Central America, and again in the Malay Peninsula, and some of the neighbouring islands, but they are absent from all other countries; so that we have closely allied species of the same genus separated from one another by the whole width of the widest ocean in the world.

(2) A somewhat similar distribution is presented by the Camel family. The true Camels are natives of Asia, but their nearest allies, the Llama, Alpaca, etc. (genus Auchenia) inhabit South America; so that although we are here concerned with genera, and not with species, they also are separated by wide stretches of sea.

(3) The same is true of the Marsupials, which occur in such varied forms in Australia and on some of the neighbouring islands, but elsewhere are only represented by a few South American species, one of which (the common Opossum) extends to the United States.

(4) Lemurs are especially abundant and varied in form in Madagascar, which is separated from the mainland of Africa by a deep channel about 250 miles in width; but a few are found in Africa, and again in India, south-east Asia and some of the adjacent islands (Borneo, etc). Here the distances are less, but still quite sufficient to make us wonder how the present distribution has been arrived at.

Many other instances could be given, but these, all relating to animals familiar to the general public, will suffice to show the main features of the problem. It is a very old problem—as old at least as the days of Buffon—but although at the present time no one doubts that each of our groups must have had a common ancestor, yet the question as to how the separation of the descendants can have been brought about is still far from being settled; indeed, owing to the disturbing influence of modern theories, there is probably more divergence of opinion now than ever before. The question is of course primarily a zoological one, and much valuable information is furnished by living animals, yet it is evident that the key to it must rest with geology, since it is only with the help of that science that we can hope to learn where the primitive ancestors lived, and by what routes migration was possible. If the geological record were perfect, our task would be an easy one, but unfortunately it is extremely imperfect, as Darwin long ago pointed out in some powerful chapters in the "Origin of Species"; and although since his time we have added enormously to our knowledge of fossils (palæontology), yet this has in many cases only served to emphasize the depth of our ignorance.

Leaving out of account the immensely long Pre-Cambrian era (Algonkian and Archæan), in which no definite fossils are found, we divide the fossiliferous strata into four epochs, Primary, Secondary, Tertiary and Quaternary, which are of very unequal length—the Quaternary being much the shortest, and the Primary the longest, more than four times as long as all the later periods put together; and broadly speaking our knowledge of the fossils of these epochs is in inverse proportion to their age and length. It follows from this that, on the whole, we know more about recently evolved groups, such as Mammals, than we do about more primitive forms; but besides that we are of course very dependent upon the conditions under which fossils are preserved. Thus plants are generally found in such a fragmentary state that it is difficult to identify species with certainty; while many of the invertebrate animals are too soft to be preserved at all. Vertebrates are on the whole our most satisfactory guides, and especially the Mammals, which, though they first appear in the Secondary epoch (a few fragments being found in the Jurassic rocks of our own neighbourhood) were mainly evolved in the Tertiary and Quaternary. Birds, though they are probably as old as Mammals, are seldom well preserved; and although Reptiles are abundant in some of the Secondary rocks, we know very little about the ancestors of existing genera, since the commonest forms of that period were the now extinct Dinosaurs. Amphibia, which first appear towards the close of the Primary epoch, are rarely found in a fossil state; and fishes, though they often afford useful information, are obviously not direct witnesses to the former distribution of land animals.

It will be seen from all this that our palæontological evidence must be interpreted with caution. The positive evidence afforded by the actual occurrence of a fossil ancestor in a given country is of course of first-class importance; but its absence must not be too readily accepted as proof that it never lived there. This applies especially to the early geological periods, of which the records are very imperfect, but it is also true of even the more modern deposits in little-known parts of the world; for except in Europe and North America our search for fossils is still in a somewhat elementary stage.

But our knowledge of the geography of the past is even more imperfect, and instead of learning from geological sources the former land connections, and inferring from them the routes taken by animals, we are forced, in nearly every case, to reverse this process, and to infer from the distribution of animals the land-bridges which must have existed. This is very unsatisfactory, as it leaves room for a great diversity of opinion as to the number, position, and age of such bridges, while the mechanism by which they were produced and destroyed is, and has long been, a matter of violent controversy. Four main theories on the subject have from time to time been propounded, and these we shall now proceed to examine in their chronological order, giving them, for convenience, the following names ; (1) The Oscillatory Theory ; (2) Wallace's Theory ; (3) Suess's Theory ; (4) Wegener's Theory.

(1) The Oscillatory Theory.

In the early part of last century geologists realised that the continents were largely composed of marine sediments, and it seemed a natural inference that, while the land had on many occasions been under the sea, the bed of the ocean had often formed dry land. The crust of the earth was in fact supposed to be in a state of oscillation—one might almost say that land and sea had been playing a game of see-saw on a gigantic scale, one rising as the other fell. This of course made it easy for zoologists to postulate land connections between continents wherever they wanted them, and these connections might, if required, be submerged and raised again at different geological periods.

But before long doubts began to arise as to the accuracy of this beautifully simple solution of our problem. It was shown that whereas the great oceans have an average depth of about 12,000 feet (2,000 fathoms)—a depth which is commonly reached at no great distance from the shore—the majority of the stratified rocks of the continents are indicative of quite shallow water (sands, muds, etc.) ; and even the Chalk, which was at one time regarded as the equivalent of the Globigerina Ooze, was proved to have been laid down at quite moderate depths—possibly not more than 50 to 100 fathoms. For these and other reasons there gradually arose among geologists a belief in what was called ' the permanence of ocean basins "—a belief, that is, that the great oceans had always occupied approximately their present positions, and did not mark the sites of lost continents : while the continental areas, though often reduced in size by submergence beneath shallow seas, had never been very much more extensive than at the present day.

But if the beds of the deep oceans have never formed dry land, how are we to explain the distribution of land animals? That was the question taken up by A. R. Wallace, and answered in his important works, " The Geographical Distribution of Animals " (1876), and " Island Life " (1880).

(2) Wallace's Theory.

Wallace, though he was firmly persuaded of the permanence of the main ocean basins, believed that we might reasonably infer former land connections where the sea is comparatively shallow. He pointed out that a lowering of general sea level by only 100 fathoms (600 feet) would join up most of the larger Pacific Islands (Sumatra, Java, Borneo, Japan, etc.) with the mainland of Asia, thereby accounting for the presence on them of a number of mammals; and, what is of more general importance, it would give us a wide belt of land uniting Asia and North America in the neighbourhood of Behring Straits. Such a bridge might possibly be sufficient to allow of all the intermigration which has obviously occurred between the Old and New Worlds, but Wallace thought that there was another connection in the North Atlantic, by way of Greenland, Iceland and the "Icelandic Ridge," where the depth of water does not exceed 500 fathoms (3,000 feet). Both these routes may have been opened and closed again at various geological periods, but both seem to have been available in the Pleistocene (Quaternary). Other connections postulated by Wallace are (1) between Madagascar and Africa, believed to necessitate a change of level of less than 500 fathoms, but breaking down before the end of the Eocene period; (2) between Asia and Australia (perhaps not more than 1,000ft.) up to about the end of the Secondary epoch; (3) between Australia and New Zealand (about 1,000 fathoms) early in the Secondary epoch. Evolution is supposed to have taken place mainly in the broad northern lands, and as new and improved forms arose, the older and less successful ones were pushed southwards, some of them being driven down to the sea and exterminated, while others survived either by taking to arboreal life (Opossums, etc.) or by occupying lands, such as Madagascar and Australia, which were isolated soon after migration took place.

When we apply these principles to special cases, we find them on the whole very well supported by palæontological evidence. Thus Tapirs were common in Europe, Asia, and North America in Quaternary times, and their present distribution has evidently been arrived at by extinction in other areas. Camels and their allies probably originated in North America, and while the true Camels migrated into Asia and even Africa in the Pleistocene, the genus Auchenia went southwards, reaching South America as early as the Pliocene. No remains of Camels are found in Europe, so they probably reached Asia by the Pacific route only (Behring Sea). Lemurs occur in the Eocene and Oligocene beds of Europe and of North and South America, so that it is evident that they once had an exceedingly wide range; and their present restriction really fits in better with Wallace's theory than with the earlier hypothesis of a continent of "Lemuria," uniting India with Africa. Marsupials occur in the Secondary and Early Tertiary beds of Europe and North America, and from the latter they soon reached South America, where, in mid-Tertiary times, they were far more numerous and varied than now. No fossils have yet been found in Asia, but seeing our general ignorance of that continent and the absence there of Early Tertiary strata, such negative evidence has but little weight against the strong probability that it was by this route that they reached Australia.

These are of course only selected cases, but many others might be cited which are equally well supported by palæontological evidence. Wallace was indeed mainly concerned with the Mammalia, and therefore with the later chapters of geological history; but within those limits he certainly made out a strong case, while he rendered excellent service by combating the too ready multiplication of land bridges, and by showing how much could be explained by migration from the north. His two northern bridges sufficiently account (except perhaps in one case, to be considered later) for the relations of the Old and New Worlds, if we assume, as nearly all geologists have hitherto done, a warmer Tertiary climate; and he clearly proves that it is not necessary to invent a trans-Pacific bridge to account for the Marsupials, or a continent of "Lemuria" in the Indian Ocean for the Lemurs.

A good deal of the opposition to his views has probably been due to want of full appreciation of his principles; thus many writers bring forward the Ratitæ (Ostrich, Rhea, and Emu) as positive proof of direct land communications in the southern hemisphere in Tertiary times; while some appear to regard this case as strengthened by the curious fact that certain parasites are common to all these birds. But even if we were sure that these parasites could live under no other conditions, this would only show that their hosts had had a common ancestor, which is, on other grounds, not improbable; but it would tell us nothing as to where that ancestor lived; and in view of the rarity of fossil birds, the absence of such ancestors from European and North American strata is not conclusive evidence against migration from the north. But several good authorities hold that the Ratitæ are not closely allied, but have been evolved independently from winged ancestors in the countries they now occupy.

Earthworms again are often quoted as proving various former land connections; but in the absence of fossils we have no idea how far back existing genera and families may have extended, and seeing that their migratory powers are by no means negligible, Wallace's routes are possibly quite sufficient for their distribution. That at any rate is the view of the latest authority on the subject, Lt. Col. Stephenson.

Yet another objection often advanced is that Wallace relies too much on accidental transport in peopling Oceanic Islands, which many writers regard as remnants of former continents. It is known that snakes sometimes travel for long distances on floating logs; and many lizards and insects have probably done the same: but it is certainly more difficult to find a means of transport for such burrowing animals as the lizard Amphisbæna, a species of which is found in Fernando Noronha, and the amphibian

Cœcilia, found in the Seychelles. Very puzzling too are the giant tortoises, which live, or have recently lived in the Seychelles, Aldabra, Mauritius, Rodriguez, and the Galapagos Islands; for it is alleged that they will not stand more than a few hours immersion in water. But they are not a very ancient group (they first appear in the European Oligocene); and seeing that no mammals occur on any of these islands, the hypothesis of direct continental communication at so late a period is even more improbable than accidental transport by some unknown means.

Perhaps a more serious obstacle to Wallace's theory is afforded by the Hystricomorpha (a sub-order of Rodents) one family of which is found in Africa and South America, but not, even as fossils, in North America; and seeing how well the fossils of that country are known, this absence is certainly remarkable; but it seems simpler to plead once more the imperfection of the record, than to demand a direct bridge between Africa and Brazil as late as the Miocene: for such a bridge must surely have led to greater resemblances between the faunas of the two continents than have ever existed.

It is however very unfortunate for Wallace that some of the soundings on which he relied have proved inaccurate; for it is now known that the channel between Madagascar and Africa is more than 1,000 fathoms deep, while that between New Zealand and Australia is over 2,000 fathoms; and the assumption of such enormous changes of level in special cases seriously undermines the theory of the permanence of ocean basins. This difficulty is boldly faced by W. D. Matthew, who, reviewing the whole situation more than thirty years later, endorses Wallace's general principles, but (on theoretical grounds) still further reduces the number of land connections. He will not admit continuous land (only a chain of islands) along the Icelandic Ridge, so that all migration between the Old and New Worlds has to go by way of Behring Straits; and he denies the former junction of Madagascar with Africa or of New Zealand with Australia. The wingless birds of New Zealand (there are no indigenous mammals) he regards as descended on the spot from winged forms; while for the transference of Lemurs and other mammals to Madagascar he relies on the huge natural rafts which are so commonly swept into the sea by tropical rivers. Living animals have often been seen on them, and they have been observed to drift as much as 1,000 miles, so that, although the colonisation of new lands in this way must require an exceptional combination of circumstances, and must therefore be rare, yet Matthew thinks it almost certain to have happened several times in all the millions of years of the earth's history. He even uses these rafts for the carriage across the South Atlantic of the Hystricomorpha; but this seems in the highest degree improbable, even if we give them a half-way resting place on mid-Atlantic islands of larger size than the existing Ascension and St. Helena.

But while Matthew, with his increased knowledge of palæontology, on the whole strengthens and confirms Wallace's theory as regards Mammals, it is open to question whether that theory is equally successful when we come to the lower Vertebrates and the Invertebrates, whose principal migrations probably occurred in Secondary and Early Tertiary times. No doubt the plea of an imperfect record increases in force as we go further back in time; while many of the objections which have been raised to Wallace's views are, as we have seen, founded on unsatisfactory premises; but on the other hand there are many resemblances between the animals of Africa and South America (especially fishes and insects), where no near allies, living or fossil, have so far been found in the Northern Hemisphere, and these have led a large number of writers to assume a bridge across the South Atlantic at least as late as the end of the Secondary epoch. When we pass still further back, into the Primary epoch, our difficulties increase, but most authorities abandon altogether the belief in permanent ocean basins. Some evidence on this point will be given later, and here it is enough to state that, in spite of Wallace's arguments, the belief in extensive bridges—even in the Tertiary—continued to be widely held, and it was not long before it received fresh support from the writings of Edouard Suess.

(3) Suess's Theory.

Suess believed that, as the core of the earth contracted, portions of the crust broke up and sank towards the centre: but the movement was always downwards, never upwards; so that, although he recognised the absence of abyssal deposits from among the continental strata, he did not find this at all incompatible with a belief in the former existence of large continental areas, which, having since sunk down and formed the sea-bottom, can never re-appear.

Of these lost continents the most important are:—

(1) *Atlantis*, which connected Europe and America over a wide front in the Primary epoch, and remained, much reduced in size, across the northern part of the Atlantic ocean until at least the middle of the Tertiary.

(2) *Gondwanaland*, a huge continent uniting India, South Africa, and South America up to the end of the Primary epoch, when it began to break up; though fragments of it remained to a much later date, one probably connecting Africa with South America and another with India in Secondary and perhaps early Tertiary times.

(3) *Antarctis*, connecting Patagonia with Australia by way of the Antarctic continent.

But although Suess thus allows us to reconstruct several broad land-bridges, yet he does not give us quite as much freedom in this respect as does the oscillatory theory; for while the older view allowed the connections to be frequently broken and re-made, this is more difficult on the newer hypothesis, which does not indeed preclude oscillations in the earlier stages of subsidence, but regards them as impossible when the broken fragments have sunk to any great depth. Suess, too, denies the possibility of any bridges across the deeper parts of the Pacific, which a few writers still demand.

These broad land-bridges, however, persisting over long periods of time, are not quite so satisfactory as they at first appear in solving the problems of distribution; for while they explain the resemblances between the faunas of two distant countries, it is doubtful whether they adequately account for the differences. Take for example Europe and North America. A large number of mammals—chiefly northern forms—are common to the two continents, but there are some striking absentees on both sides; Badgers, Goats, Pigs (Sus), and Hedgehogs are wanting in America; and to these we may add Hyaenas and Hippopotami, which, though common in Western Europe in Pleistocene times, never reached the New World. On the other hand no Skunks, Racoons, or Opossums have migrated into Europe. And when we turn to the birds the differences are even more conspicuous, 75 per cent. of American genera being unknown in the Old World. All this is quite intelligible if the connecting land was narrow and intermittent, as Wallace maintained, but is more difficult to reconcile with the wider and more prolonged connection of Suess's theory; while the fact that the late Eocene faunas were even less alike than those of to-day is still more opposed to a long-continued land-bridge.

Gondwanaland has an important bearing on certain problems of the Primary epoch to which we shall refer later; but the continuance of a portion of it across the Indian Ocean into mid-Tertiary times is not necessary to explain the distribution of the Lemurs; while, as already pointed out, the existence of a similar bridge for a like period across the South Atlantic, though it would explain the Hystricomorpha, would inevitably lead to more intermingling of the two faunas than has actually occurred. And for this reason few of Suess's followers maintain such a bridge beyond the Secondary epoch.

Wallace himself admitted that some plants and animals might have made their way across the sea from the Antarctic continent to Australia and South America, but he saw no reason to suppose that there was an actual land connection. Since his time however several new forms of fossil Marsupials have been found in South America, one of which (Borhyæna) somewhat closely resembles the Australian Thylacinus; and this, coupled with the continued absence of fossil Marsupials from Asia, has helped to revive the belief in "Antarctis" (connected both with Patagonia and Australia) as a migration route for those primitive mammals.

But we know so little about the Secondary and early Tertiary deposits of Asia, that the absence of fossil Marsupials need not trouble us; while the same absence of fossils in the Antarctic continent might just as well be used as an argument against the southern route. As to Borhyæna, Matthew considers that its resemblance to Thylacinus is a case of convergent evolution due to similarity of habits; and in this connection we must not lose sight of the singular superficial likeness that exists between the skulls of Thylacinus and of dogs—belonging to wholly distinct orders of mammals. Matthew also suggests that the helpless giant Penguin, found in Patagonia and in Seymour Island, is evidence, so far as it goes, against the co-existence of carnivorous mammals. But the close relations existing among Invertebrates and plants between Patagonia and Australia have convinced many authorities that a connection by way of the Antarctic continent must have existed at some time, though whether this was the route of Marsupial migration is extremely doubtful.

It is worthy of remark that while every point of biological resemblance between the two sides of the Atlantic is eagerly seized upon as evidence of a former bridge, similar features on either side of the Pacific have to be accounted for by Suess's followers either on Wallace's principles of migration from the north (Behring Straits) or else by very roundabout routes across the Atlantic. Some doubt may exist as to the Tapirs, which are found fossil in Europe, but the Camels certainly migrated by Behring Straits, and probably many other mammals took the same route; while the following cases among the lower Vertebrates may probably be placed in the same category; (1) Alligators are specially characteristic of the tropical and sub-tropical rivers and swamps of America : yet one species is found in China, on the opposite side of the Pacific. (2) One species of Amblystoma (allied to Newts) lives in China, and another in North America. (3) The giant Salamander of Japan (Megalobatra) is so closely allied to the North American Cryptobranchus that it is often placed in the same genus.

We must also, in estimating the value of land-bridges, take into account the numerous cases in which direct land connection is out of the question, and a wider range in former times, with much subsequent extinction, must be assumed on any hypothesis. Thus Insectivora of the family Centetidæ are found in Madagascar and in the West Indies, but not on the mainland of Africa or America. Iguanidæ are found in America, Madagascar and Fiji. Among snakes, Philodryas, Heterodon, and Herpetodryas occur in America and Madagascar, and the last named in China as well. In all these cases we are clearly dealing with animals of very ancient origin, with plenty of time for migration and extermination, as well as for accidental transport; but they are at least as well explained by Wallace's theory as by that of more direct land-bridges.

Another excellent example of the danger of assuming a direct connection on the strength of affinity alone is afforded by the Dinosaurs, a group of reptiles common in the Secondary epoch, but now extinct. They are comparatively scarce in the southern hemisphere, but some of those found in South Africa have their nearest allies in Siberia, and not in the intervening countries : but here it is evident that a direct land-bridge will not help us, and the extreme imperfection of the geological record affords the only possible explanation.

We see then that direct and long-continued connections across the deep oceans are not without their difficulties in solving the problems of geographical distribution, even if we relegate most of them to earlier periods than Wallace was (in the main) concerned with : but it is from the physical side of geology that the most powerful opposition to Suess's theory has come.

It is very generally agreed among geologists, Suess himself included, that the crust of the earth consists of at least two layers of different density, a lighter " Sial " which forms the continents, and a denser " Sima " which passes under the continental Sial, but is probably left bare on the floors of the great oceans. Careful observations on gravity in various parts of the world have proved beyond reasonable doubt that the Sima is plastic, and that the blocks of Sial actually *float* in it, very much as ice floats in water; and if the equilibrium is as complete as it is alleged to be, it is no more possible for masses of the lighter material to sink down 12,000 feet or more into the heavier than for a block of ice to sink to the bottom of a pond. But if that is so, then the idea that the floors of the great oceans are paved with fragments of lost continents must be abandoned, and the only bridges permissible are those where, as in the case of Behring Straits, the water is quite shallow. It is obvious then that this doctrine of " Isostasy "*—of the floatation of the continents—though accepted by Matthew, is in direct conflict with the belief held by the majority of palæontologists—including Wallace himself—that land bridges across deep parts of the ocean, are essential in explaining animal migrations. Hence there has arisen something like a deadlock between the two schools: on the one hand we have Suess's case which rests, not so much on the distribution of animals, as on certain features of geological structure; and it seems hardly possible that he can be wholly wrong, for vertical movements of 12,000 feet and more have undoubtedly occurred within the continental blocks; and between the island of Rhodes and the mainland of Asia Minor a channel 10,000 feet deep seems to have been formed since the Pliocene. On the other hand it is declared that no flaw can be found in the case for Isostasy, and all attempts to modify it, and so reconcile it with the foundering of continents, have so far failed. It was at this controversial stage that Wegener came forward with a proposal, which is not so much a compromise as a cutting of the Gordian knot.

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*Although the name " Isostasy " is American, the theory was first clearly propounded by Osmond Fisher in " Physics of the Earth's Crust " (1889).

(4) Wegener's Theory.

Wegener, as a firm believer in isostasy, denies the possibility of former bridges across the great oceans; and although he admits the occurrence of such modest movements of relative sea-level as are postulated by Matthew, yet he regards them as hopelessly inadequate to account for the observed zoological facts. His remedy is to move the floating blocks of sial laterally over the surface of the sima, and by bringing the continents into actual contact one with another to facilitate the migration of animals. He gathers all the continents together into one vast "Pangæa," which only began to split up towards the close of the Primary epoch. The most important rift, which started in the south and worked gradually northwards, gave rise to the Atlantic Ocean, the southern portion of which was completed in the Secondary epoch, while the final separation of Europe and America was left to the Quaternary. The other changes are too complicated to be explained in detail here; but it may be mentioned that although Australia was early separated from Asia, it maintained connection with Antarctis, and so indirectly with South America, until the end of the Tertiary; and that no contact ever occurred between Eastern Asia and Western America, except across the now shallow area of Behring Sea.

,But whatever may be the physical merits of Wegener's hypothesis—and these are still in dispute—as an explanation of the migrations of animals it is decidedly less satisfactory than Suess's. We found it something of a difficulty in the latter case that the resemblances between the faunas of Europe and North America were not greater than they are, in view of the supposed long-continued connection across a fairly wide front: but in that case some allowance would have to be made for the great length (over 2,000 miles) of the bridges to be traversed. But this objection becomes enormously stronger against the views of Wegener, who annihilates distance, and places the two continents in actual contact. Even leaving the mammals out of account, it is surely amazing that the birds of the eastern coast of North America should differ as much and perhaps more from those of Western Europe than the latter do from those of Japan, if the former coasts had been in actual contact up to the beginning of the Quaternary epoch.

But this movement apart of the continents is only part of Wegener's far-reaching theory, which seeks also to explain the variations of geological climate. Physicists have always declared that it is impossible for any important change to have occurred in the positions of the poles of the earth; but, by sliding the thin superficial film of sial over the great central core of heavier material, Wegener leaves the poles of the latter unchanged, while altering the latitudes of the continents to any desired extent: and in effect that comes to much the same thing; for if it be true (as Wegener asserts) that England was nearer the North Pole in the Pleistocene than it is now, it makes no practical difference whether we describe the recent change as a movement of the pole away from England, or a movement of England away from the pole. The latter may be technically more correct, but in practice the former is somewhat more convenient.

One of Wegener's greatest successes lies in his explanation of certain events at the close of the Carboniferous period. First of all a sheet of ice spread over all the southern continents, South America, Africa, and Australia, up to the Tropic of Capricorn, and over India even nearer the equator, although few traces (Wegener says none) of glaciation are found in Europe and North America; and when this ice disappeared a remarkable collection of ferns, or fern-like plants, called the "Glossopteris flora," extended itself rapidly all over the same areas, including India. Wegener explains these two events as follows. All these four countries were united at the southern end of his "Pangæa," a much-elongated India being wedged in between South Africa and Australia; and since the south pole was close to the apex of this continent, glaciation was experienced by them all. Gradually however, the pole shifted southwards, the ice disappeared, and the Glossopteris flora, wherever it originated, had no difficulty in covering all four continents, because they were still all massed together. So far as the glaciation is concerned, this hypothesis seems to be negatived by the presence (which Wegener boldly denies) of contemporary glaciers in North America, actually on the supposed equator of that period; but his explanation of the puzzling distribution of the Glossopteris flora is in many ways the best that has yet been offered. It can hardly, on Wallace's principle, have come from the north, since it does not appear in the northern hemisphere till later; and Suess's Gondwanaland does not account for the apparently simultaneous appearance of the flora at all points of that vast continent. Ignorance can no doubt be pleaded up to a point; for in such a remote period as the Carboniferous the accurate correlation of strata in different countries is well nigh impossible, and events that seem to be contemporaneous may really have been separated by millions of years. But when all allowance has been made for this, it seems almost certain that the doctrine of the continuity of ocean basins must be relaxed in the case of the Primary epoch; and some of those most familiar with the Carboniferous period incline towards Wegener's explanation.

But however this may be, the problems of distribution in later epochs do not seem to be much assisted by Wegener's theories, either as regards the contact of continents, or in relation to climatic changes. To the former we may oppose all the zoological arguments used against Suess's land bridges, sometimes, as we have seen, with much increased force; but the latter open up certain very complicated and difficult questions which must be considered at some length. From the nature of the fossils (especially plants) it has hitherto been generally inferred by geologists that the climate of northern Europe was much warmer in Eocene times than it is now, and that the temperature gradually fell throughout the Tertiary epoch, until in the Quaternary the Glacial period was reached; but of late there has been a strong reaction against this view, and doubts have been freely expressed as to whether fossils offer us any valid criterion of temperature at all. But this reaction seems to be going too far. No doubt it is true—definite examples can be cited to prove it—that extinct species had not necessarily the same climatic requirements as their living allies; and the difficulties arising from this source increase as we go further back in geological time; but when we rely, not upon individual species, but upon the general *facies* of the fauna and flora, it seems unreasonable to deny that a general lowering of temperature throughout the Tertiary did occur, although the amount of that fall may be less accurately measurable than was formerly supposed. And while this is probably true of Europe as a whole, the rich flora—almost tropical in appearance—found in the Cretaceous and Tertiary strata of Greenland and Spitzbergen must surely prove a much more genial climate in the far north than obtains at the present day. Similar evidence exists in relation to the South Pole, and although observations have so far been possible at very few points in either the Arctic or Antarctic circles, it has been generally assumed that the change in climate was circum-polar, though not of course that the isotherms at all closely followed the parallels of latitude. And the bearing of such an assumption on the distribution of animals is of no small importance. Two species of Manatee are found on opposite sides of the Atlantic, one ranging from Senegal to Natal, the other from the Antilles to South America; while one form of monk-seal (Monachus) occurs on the north-west coast of Africa and in the Eastern Mediterranean, and another (perhaps a different genus) is found in the Gulf of Mexico. Since these animals are all coastal in their habits, and incapable of crossing a wide ocean, they have been hailed by the believers in bridges as conclusive evidence of a transatlantic connection in fairly low latitudes in Tertiary times. Wallace and Matthew on the other hand think that their distribution can be quite well explained by migration along the line of the Icelandic Ridge—whether along a continuous coast or by way of adjacent islands is immaterial; but it is important to note that this view is only possible if we assume that the climate of the North Atlantic was formerly warmer than now, unless indeed we suppose (which is less probable) that both sets of animals have changed their climatic requirements.

But before deciding between these rival hypotheses, it is desirable to turn our attention to the Pacific Ocean, on the one side of which we find Alligators in abundance in the Central and South American rivers, while on the other we find a closely allied species in the Yang-Tse-Kiang. Now in the face of Suess's opposition very few geologists have attempted to construct bridges across the Pacific further south than Behring Sea (about 60° N. Latitude) as postulated by Wallace. Moreover in this case changes in climatic habit are ruled out, since no reptile of the size of an Alligator could survive the present-day cold of latitude 60° N.; and this assertion does not rest solely upon inference from the distribution of existing reptiles, but is based upon physical requirements of cold-blooded animals. Mammals and birds, with high body-temperatures, can stand a great degree of cold; but reptiles can not. Small ones, like our native lizards, which are easily warmed through, can endure a temperate climate, but larger reptiles seem inevitably to require a more powerful sun to heat them to the requisite degree. It appears therefore that, on any hypothesis, except that of a more southern trans-Pacific bridge, we are bound to assume the migration of the alligators by a connection not much further south than latitude 60° and a temperature in the North Pacific decidedly higher than at present. But if this explanation—which is entirely in accordance with Wallace's principles—is sufficient in the one case, there can be no need in the other to construct a trans-Atlantic bridge further south than the Icelandic Ridge; and moreover we seem to have, in this alligator case, confirmation of the old hypothesis of a circum-polar increase in temperature in Tertiary times.

But Wegener's hypotheses put a wholly different complexion on these climatic problems; for while he accepts the geological evidence as to alterations of temperature in Northern Europe from tropical in the Eocene to arctic in the Pleistocene, he obtains these climates not by a world-wide change in meteorological conditions, but by shifting the positions of the poles. Thus in the Eocene he places the North pole in the Pacific, close to the Aleutian Islands, and the equator in central Europe: during the Oligocene, Miocene, and Pliocene the pole travelled first northwards into the Arctic Ocean, then eastwards across the north coast of America, till in the early Pleistocene it reached the Greenland coast in about latitude 70°, longitude 55° W. Up to the end of the Pliocene the climatic changes arising out of these polar movements did not greatly affect the distribution of animals between the Old and New Worlds on the Atlantic side, because the two were still in contact with one another. Consequently the North Atlantic was only partially present, and the Manatees and Monk-seals could wander round its northern margin from one continent to the other, if we put this margin far enough south to give the requisite climate. But in the Pacific the conditions were very different.

Wegener himself admits no connection between Asia and North America further south than Behring Straits, and these, in Eocene times, were close to the pole. The climate of this region would then gradually improve, but even in the Pleistocene this bridge would be in (about) lat. 45°, which is far too cold for alligators. But the only other way of accounting for their distribution is to suppose that they once spread all round the coast of Asia and Europe, from which they crossed the Atlantic to America: but the geological evidence, and the close affinity of the species are not in favour of this somewhat extravagant hypothesis, so that these animals present a considerable obstacle to Wegener's views.

The Dinosaurs also, if they were really cold-blooded animals, are opposed to Wegener's hypothesis; for, on his own reckoning, they range too far north in Canada (about 45°), and much too far south in Africa (70°). Unfortunately, although we class them as Reptiles, we cannot be certain that they were not warm-blooded: but even so it is significant that their northern limit follows a zone (45° to 50°) all round the world, which is roughly parallel to the equator; and they reach about the same latitude (45°) in Patagonia; whereas on Wegener's hypothesis they are distributed without any reference to climatic zones, being tropical in Europe, temperate in Canada, and frigid in Africa.

If any conclusions are permissible in a subject so full of divers opinions, we may perhaps advance tentatively the following propositions;

(1) The Oscillatory Theory is almost universally abandoned so far as the depths of the ocean are concerned. But a good deal of evidence points to more frequent making and breaking of such bridges as existed than Suess's theory allows.

(2) A connection between the Old and New Worlds in the neighbourhood of Behring Straits is universally admitted, but few authorities demand any further bridge across the Pacific.

(3) Wegener's Theory, whatever its merits in other directions, is unsatisfactory, both geographically and climatically, as an explanation of the distribution of land animals.

(4) Suess's Theory is so firmly founded on several branches of geology, that it is unlikely to be altogether mistaken; and it is therefore not unreasonable to expect that some modification of the Isostatic Theory will be found which will bring the two into harmony. Already attempts in this direction have been made by several authors (Barrell, Gregory, etc.), but none have yet achieved general acceptance.

But even if these propositions are accepted, they only take us half way across the sea of controversy, for we are still unable to determine how many bridges are required, and at what periods they appeared and disappeared. It seems desirable on general grounds to reduce their number to a minimum, and to follow Wallace's principles as far as possible; but even if we accept Suess's three lost continents (Atlantis, Gondwanaland, and Antarctis), we are still a long way from deciding upon their age or extent, for at present hardly any two authorities agree. Nor does there seem to be any prospect of a general agreement in the near future.

Selected Papers.

"Glacial Epochs and their Causes."

By Henry Bury, M.A., F.G.S.

It is just ninety years since Louis Agassiz pointed out that the northern parts of Great Britain had been covered by a sheet of ice in the Pleistocene period; and although his fellow geologists were at first sceptical, it was not long before they too learnt to recognise the signs of glacial action, the more important of which may be classified as follows :—

A. Direct action on underlying rocks. Glaciers, by virtue of their movements and the stones embedded in their bases, exercise a powerful grinding influence on the rocks below, which results in the formation of (1) Rounded hummocks of rock known by the fanciful name of "roches moutonnées," (2) Parallel striae or scratches, which are of great service in showing the direction in which the glaciers moved.

B. Transporting action. This may show itself in several ways. (1) Moraines may be left behind by the retreating ice similar in character to those of existing glaciers. (2) Blocks of stone, often of enormous size, are found stranded many miles from their source, and in districts to which they obviously do not belong. As an instance of such "erratic blocks" we may mention the many boulders of Shap granite which have been carried from the Lake district, across the Pennine Hills, and deposited in various parts of Yorkshire. (3) Boulder Clay—that is, masses of clay full of boulders of all sizes and shapes, irregularly arranged, and often scratched—is a well known and characteristic product of glacial action, though there has been much controversy as to its exact mode of origin.

By tracing these features in various countries it was proved that a great ice sheet had spread all over northern Europe, down to about the 50th parallel of latitude, and over North America to the 40th and even (in some places) the 35th parallel. In the southern hemisphere also the ice reached 40° south latitude in several localities, though owing to the scarcity of land (except in the Antarctic Continent) at higher latitudes, the glacial features are far more limited in area. In our own country the ice-sheet did not extend south of the Thames valley, but there may have been small local glaciers in the southern counties; and the plateau gravels, which cover such large areas in our own district, are almost certainly due, in part at least, to floods caused by the melting of ice and snow, so that the climate even here must have been very severe. The majority of geologists regard boulder clay as having been formed underneath the glaciers; but some hold that it was a marine sedimentary deposit, the boulders having been dropped into it from floating ice. This involves a belief in considerable changes in sea-level during the glacial period, which are not indeed impossible, but lack corroborative evidence; for few now regard the sea-shells which occur on the Welsh mountains at 1,250ft. O.D. as evidence of submergence of the land to that extent, since we possess clear proof elsewhere of the power of glaciers to raise stones and other material above the levels from which they started. In Canada, for example, boulders of Archæan rocks were picked up by a glacier near Hudson Bay, at a height of not more than 1,500ft. above the sea, carried 500 miles to the Rocky Mountains, and there deposited at 4,500ft. above the sea—that is to say 3,000ft. above their starting point; and since in this case there can be no question of marine action, the elevation must be attributed to some obscure movements within the ice itself.

Attempts were made many years ago, by James Geikie and others, to show that the Pleistocene glaciation was not continuous, but was interrupted by one or more " interglacial " periods, during which the ice retreated and the climate became milder—in some cases even milder than at present; but it was not until the publication of Penck and Brückner's great work on the glaciation of the Alps that this belief became at all common, and even then doubts remained as to whether all the four glacial periods of those authors could be traced outside the Alpine region; while a few geologists still maintained that in northern Europe (England and Scandinavia) there was no evidence of any interglacial period at all. No one has done more to clear up this difficult problem than Mr. Reid Moir, who finds in East Anglia traces of all the four glacial periods described by Penck and Brückner : but his conclusions, which rest largely on the different forms of flint implements occurring in different glacial deposits, are regarded as highly unorthodox in certain quarters; and he has consequently had to submit to a storm of criticism and abuse from those who, though trained in geology, have little or no knowledge of flint implements. A great diversity of opinion therefore has till recently existed, and still to a large extent persists, as can be seen from the table on next page, in which are set out the views of seven of the principal writers on the subject; the sub-divisions of the glacial period being given across the top, and the names of the different human culture-periods in the left-hand column.

It may be well also to give a brief summary of the main grounds of Mr. Moir's belief.

1. *Pre-Glacial* implements (Pre-Chellean), now generally recognised as human, are found under the Red Crag of Suffolk, usually, but perhaps erroneously, ascribed to the Pliocene.

2. *First Glacial* (*Günz*). Scratched stones and erratic

Table showing the Relations of the Glacial and Interglacial Periods to Human Industries.

	Pre-Glacial.	Günz.	Inter-Glacial I.	Mindel.	Inter-Glacial II.	Riss.	Inter-Glacial III.	Würm.	Retreat of Ice.
La Madeleine							M.	G. S.	B.F.O.P.
Solutré							M.P.S.	G.	B.F.O.
Aurignac							M.P.S.	G.O.	B.F.
Le Moustier					M.	P.	F.G.O.S.	B.	
St, Acheul					M.P.	G.S.	B.O.F.		
Chelles			M.		F.G.P.S.	O.	B.		
Pre-Chelles	M.F.S								

NAMES OF AUTHORS: B=Boule ; F =Peake and Fleure ; G=Geikie ; M=Moir ; O=Obermaier ; P=Penck ; S=Sollas.

pebbles in the Crag beds indicate a colder climate than now, though they may have been brought by floating ice, and not be direct products of a British glacier.

3. *First Interglacial.* The Cromer Forest Beds show a warmer climate, and at the base of them Mr. Moir has found implements which he regards as early Chelles.

4. *Second Glacial* (*Mindel*). Here we have the Lower Boulder Clay of East Anglia, in which has been found a typical Chellean implement; and since man cannot have existed under the glacier (or in the sea at its foot), this tool must be derived from the previous interglacial period.

5. *Second Interglacial.* Sands and gravels with many St. Acheul and a few early Le Moustier implements occur in many parts of East Anglia (Hoxne, Ipswich, etc.).

6. *Third Glacial* (*Riss*). This is represented by the Upper Chalky Boulder Clay of East Anglia. Implements of St. Acheul and Le Moustier age have been found in it.

7. *Third Interglacial.* From beds of this age at Ipswich Mr. Moir has obtained late Le Moustier as well as Aurignac and Solutré implements.

8. *Fourth Glacial* (*Würm*). In the " Brown Boulder Clay " of Norfolk Mr. Moir found in the autumn of 1929 Aurignacian and perhaps Magdalenian implements, and Mr. Burchell has since made similar discoveries in Yorkshire. This is important because until recently there was a doubt as to whether the Chalky Boulder Clay represented the third or fourth glacial period, and many authorities regarded the Upper Palæolithic (Aurignac to La Madeleine) as " post-glacial " (i.e., as later than the Würm glaciation) and concerned, at most, with one of the minor advances of the ice after that period. But the Brown Boulder Clay is clearly, from its contents, later than the Chalky Boulder Clay, and the glaciation which brought it as far south as Norfolk must have been a major, and not a minor one : so that these finds confirm Mr. Moir's previously expressed opinion that the Aurignacian is older than the Würm glaciation, though the position of the Magdalenian is still in doubt.

Many attempts have been made to assign dates to this Pleistocene Ice Age, but although some success has been achieved in measuring the time which has elapsed since the fourth glaciation, the total length of the glacial periods is still unknown, for the astronomical methods on which so much reliance was at one time placed are of doubtful value, and we are thrown back upon estimates which rest on very uncertain data. It appears, however, that the advance of the ice was in no way a sudden catastrophe, taking the whole world by surprise, but that it allowed plenty of time for plants—including forest trees—to retreat before it. In Europe, it is true, these plants suffered many casualties, because their retreat was barred in the south by mountains and seas; but in America, where the line of retreat was open from Canada to the Gulf of Mexico, the migrations were carried out with very little loss, with the result that North America has now more species of forest trees than Europe.

The Swedish geologist de Geer has called attention to certain " banded " clays, common in Sweden and elsewhere, each band of which is the product of the melting of the ice in a single year; and by counting these bands he has succeeded in fixing the time which has elapsed since the retreating ice reached Stockholm at 16,500 years. Unfortunately our knowledge of previous stages is still imperfect, but there is reason to believe that the ice had already been retreating for at least 5,000 years, and an estimate made in Switzerland, which is based on wholly different data, gives the not improbable total of 25,000 years since the last glacial maximum. Assuming that this was the Würm period—which is probable, but not undisputed—we have behind it three earlier glaciations, some of them apparently of far greater length and intensity, and three interglacial periods of unknown duration; and although little reliance can be placed on the details of any of the estimates yet made, it is generally agreed that the whole Ice Age must have been spread over several hundred thousand years. And yet apparently primitive man had already arrived in England before the beginning of it !

As the Pleistocene period, to which we have so far confined our attention, occupies less than a thousandth part of the whole of geological history, it is not surprising to find that other cold periods have preceded it; but we should form a very one-sided idea of our subject if we concerned ourselves solely with these colder epochs, and left out of account all the evidence as to the prevalence, on many occasions, of climates warmer than those of the present day. It is not enough to frame a theory, as so many writers have done, which accounts for only one of the extremes of temperature; it is quite as important, if not more so, to discover why many areas of the earth's surface, including parts at least of the polar circles, were apparently, throughout a large portion of geological time, warmer than they are now. It must however be admitted that on this point our evidence is not quite so clear as in the case of glacial periods. Glaciers, as we have already seen, can be traced by definite geological features; but warm periods leave no such relics, and we have to fall back on biological evidence of a less satisfactory nature. It is well known that different existing groups of plants and animals are characteristic of different climatic zones, and by comparing fossil with living forms, it seemed to the older school of geologists an easy matter to draw inferences as to former climates; but of late there has been a strong reaction against that attitude, and great stress has been laid upon the need for caution in drawing such conclusions, because we can never be certain that the fossil species had the same habits as their modern descendants. Let us, for example, compare the present and past distribution of elephants and rhinoceroses. All the existing species are tropical or subtropical, but some of the closely-allied Pleistocene forms, protected (as we know from the fortunate preservation of actual carcases) by thick woolly coats, were able to live in Siberia, well within the Arctic circle; and similar lessons as to the different climatic requirements of nearly-allied species can be learnt from plants. In most latitudes therefore it seems unsafe to draw anything but general conclusions, not from individual species, but from a comprehensive study of the fauna and flora as a whole; and we must be careful not to compare too closely the fossil and living forms, and in particular not to regard fossil plants (as has been done in the past) as accurate self-registering thermometers. But when we find flourishing communities of well-developed plants within the Arctic and Antarctic circles, it is impossible to resist the conclusion that the climate of those areas must have been more genial than it is at present.

Although our geological knowledge of many parts of the world is still very imperfect, it appears to be certain that glacial periods at all comparable with that of the Pleistocene are the exception, and that warmer climates than the present have been the rule in such countries as Greenland and Spitzbergen—so much warmer that, according to some authorities, permanent ice must have been altogether absent from the polar regions. There are no important signs of ice-action in the early Tertiary or Secondary periods, and we have to go back as far as the Permian and Carboniferous before we find glaciation on such a large scale as in the Pleistocene : but it is a curious feature of that earlier Ice Age that, though it affected the Southern Hemisphere right up to the tropics, very little trace of it is to be found in the Northern Hemisphere. But to that we shall return later. The only other important glacial periods—rather uncertain in number—belong to the Pre-Cambrian (Archaean) epoch, one of them coming immediately before the Cambrian, while another was apparently associated with the Keewatin and Sudbury strata, which are the oldest sedimentary rocks known. But as we go further and further back in time the difficulty of recognising glacial action increases, while in the Pre-Cambrian the absence of fossils deprives us of all evidence regarding warmer periods.

The rare glacial periods, Pleistocene, Permo-Carboniferous, and Pre-Cambrian appear to be separated from one another by intervals of 200-250 million years, but no definite rhythm is observable; there does however appear to be some relation between them and the great periods of mountain building. The last of these periods began in the Miocene, was continued in the Pliocene, and was then followed by the Pleistocene glaciation : the Permo-Carboniferous glaciation followed closely on another phase of mountain building; while the same sequence occurred, as far as we can judge, in the case of the Pre-Cambrian ice ages; but what the meaning of this sequence may be must be considered later.

Of the many hypotheses put forward to account for these Glacial Epochs, only a few can be considered here, which may be roughly classified as Astronomical, Meteorological, and Geographical. In the first category is Dr. James Croll's theory, formerly widely accepted, but now fallen into disrepute, that the main factors were changes in the eccentricity of the earth's orbit round the sun. Whenever this eccentricity, which varies slowly, is at or near its maximum, there arise, according to Croll, glacial conditions in that hemisphere which has its winter in "aphelion," i.e., when it is furthest from the sun; but owing to the precessional movement of the earth's axis, this condition of winter in aphelion shifts every 10,500 years to the opposite pole, and the glacial conditions shift with it. But apart from certain meteorological difficulties, the following geological objections are fatal to this hypothesis:—(1) It requires the ice to alternate from one hemisphere to the other, whereas it is almost certain that, in the Pleistocene at any rate, both were simultaneously affected; (2) It gives far more advances and retreats of the ice than we have any record of; (3) It makes the last important glaciation come to an end 80,000 years ago, whereas 20,000 is a far more probable figure; (4) It gives no adequate explanation of the warm climates of earlier geological periods; (5) There should be other glacial epochs in Tertiary and Secondary times. Several writers have proposed modifications of the theory which overcome the two first objections; but the rest remain.

The late General Drayson propounded another astronomical theory depending on alleged changes in the obliquity of the earth's axis to the plane of the ecliptic. Astronomers generally regard the precessional cycle as taking about 21,000 years, and the obliquity as remaining very nearly constant: but Drayson postulated a cycle of 31,000 years, with the obliquity rising from 23° at one point to 35° at another; and he declared that in the latter position both poles would be glaciated at once down to about latitude 45°. Apart however from the fact that astronomers do not accept Drayson's reasoning, the geological objections are quite as cogent as in Croll's case. (1) It puts the last maximum of cold at only 15,000 years ago, though de Geer has shown that the ice was then in full retreat; (2) It gives 30 glacial epochs in the last million years, whereas we can only find four; (3) It affords no explanation of the absence of glaciation in Tertiary and Secondary times; (4) It fails to account for the warm periods, for we have (on Drayson's own showing) almost reached the minimum of obliquity, but are by no means at the maximum of temperature.

A third hypothesis attributes the changes of climate to variations in the heat given out by the sun. Probably the changes of temperature required would not be very large, but they would have to act over very long periods, far exceeding the sun-spot and

Brückner cycles, which are the only rhythmic changes of which we have actual knowledge. De Geer assures us that simultaneous variations in the rate of retreat of the ice can be traced in Scandinavia and in North and South America; and it is possible that, when his records have been thoroughly examined, they may afford further insight into variations of solar heat; but at present we have no direct observations, and no theoretical considerations which would enable us to infer long-period fluctuations of the size required. So that the hypothesis, though otherwise attractive, is weak in its foundations.

Under the heading of meteorological hypotheses, we may place those which depend on variations in the composition of the atmosphere: but these may be dismissed briefly as insufficient in themselves to cause the required degree of change. To some extent carbonic acid gas (CO_2) is important in retaining the sun's heat; but there is no proof or probability that the amount present has varied in the past to any great degree, and since aqueous vapour exercises practically the same function, the removal of all CO_2 from the atmosphere (if such a thing were possible) would hardly produce an ice age.

Of somewhat more importance perhaps are variations in the amount of volcanic dust, for it seems to be proved that after big eruptions the general temperature of the earth is lowered for a time; but the glacial periods do not accord at all closely with the periods of greatest volcanic action; and even if all dust could be removed, it is unlikely that the temperature would be raised to any important extent.

We now come to the geographical hypotheses, foremost among which is one which may be called Brooks's theory, because it has been very ably supported of late years by Dr. C. E. Brooks; but he did not invent it, and in fact, except for some meteorological details, a clearer account of it will be found in Wallace's "Island Life" than in either of the recent volumes by Dr. Brooks, who seems to be unacquainted with Wallace's work. The following are the more important factors. (1) Owing to the well-known fact that water parts with heat more slowly than land, continental climates are usually more extreme than coastal ones; and therefore anything which reduces the size of the continents, or breaks them up into islands, will tend to produce milder climates. (2) The higher we go up mountains the lower the temperature becomes, until, even in the tropics, we reach a level of perpetual snow. We should therefore expect that an increase in the average altitude of continents would lower the general temperature, while a decrease would raise it. Now both these factors show considerable variations in past time, and on the whole they vary in the same climatic direction. The land areas of the world appear to attain, either during or just after periods of mountain building, their maximum elevation, as well as their maximum lateral extension, thereby lowering temperature. On the other hand, during the long periods of quiescence of the earth's crust, not only are the land surfaces worn down by prolonged denudation, but at the same time the sea tends to creep further over the margins of the continents, giving us the phenomena of "transgression"; so that we have not only a lowering of average height of the land, but also a reduction of its area, and a breaking up of the continents into a number of smaller masses; all of which causes combine to produce milder climates just in those geological periods where we actually find them. (3) The third important factor is the distribution of land and sea, as affecting oceanic currents. If there were no land the warm water of the equator would flow outwards to the poles, and return somewhat cooler along the bottom; but so much heat would in this way be carried to the polar seas that they would probably be a very long way from freezing. Land however interferes with this free circulation, and at the present time the only free passage from the equator to the north pole is by the Atlantic, and even this is somewhat marred by the shallow "Icelandic Ridge" which stretches from Greenland to Europe, and prevents the free return along the bottom of the cold polar waters. Behring Straits are too narrow and too shallow to allow any appreciable flow of equatorial currents to the polar sea. But in Pleistocene times there is reason to believe that much of the Icelandic Ridge was above water, thereby cutting off the Gulf Stream from Norway, and lowering the temperature of the polar seas. On the other hand in Eocene times, not only was Europe cut up into several minor areas, but there was probably a continuous sea from the Indian to the Arctic Ocean across western Asia; so that a milder northern climate was to be expected, and we have less reason to wonder at the abundant flora found in the Eocene beds of Greenland. Our knowledge of the geography of early geological periods is still very deficient, but we seem justified in saying that all three of Brooks's main factors have, on the whole, varied in the direction required by theory, the chief trouble being that we have no quantitative knowledge of their effects, and there is therefore room for doubt as to whether, even under the most favourable circumstances, these effects would be quite as great as we require. A further drawback is that no satisfactory explanation is provided for the fluctuations of climate during the Pleistocene period; for the geographical changes during that time hardly seem sufficient to account for them; and indeed Brooks himself admits that there have been considerable changes of climate in recent times which cannot be explained in this way.

Wegener's much discussed hypothesis of Continental Drift, to which we come next, is still *sub judice*, and will only be considered here so far as it affords an explanation of climatic changes. It was suggested many years ago, in order to account for the presence of coal in Spitzbergen, that the north pole might have shifted its position, so as to place that country outside the arctic circle; but this was declared by physicists to be impossible.

Wegener, however, puts forward what is really the same idea in a less objectionable form, by postulating a sliding of the continents over the surface of the globe, while the poles remain, as regards the earth as a whole, constant in position. Of the many facts for which he seeks to account in this way. space only permits us to consider two; (1) the abundance of plant life in Greenland in Cretaceous and Eocene times; and (2) the distribution of the ice and the " Glossopteris flora " in the Carboniferous period.

Wegener explains the former case by supposing that at the periods mentioned the north pole was in the Pacific Ocean, between Alaska and the Sandwich Isles, which would give Greenland at least a temperate climate. But while we may readily concede that such a climate might satisfy the flora (tropical though it is in appearance), it is by no means certain that we could not obtain an equally good temperature on Brooks's hypothesis, without having recourse to Wegener's more revolutionary measures. There is perhaps some doubt as to whether well-grown trees could survive the prolonged winter night of the Arctic circle, and experiment on this point is, as Professor Seward points out, desirable; but in the present state of our knowledge there is nothing in the flora of Greenland to compel us to accept Wegener's hypothesis in preference to Brooks's.

The case of glaciation in the Carboniferous period presents more difficulties. The great ice-sheets are found mainly, if not solely, in India and the southern continents; and immediately after this ice-age the rapid spread of the hardy " Glossopteris flora " over precisely the same areas—far apart though they now are—requires explanation. Wegener overcomes both these difficulties by making all these continents adhere together at a point close to the South Pole, from which they have since receded. South America, Africa, and Australia have simply diverged, while India has been reduced to a quarter of its former length by the folding of the Himalayan mountain range, at the same time passing from south to north of the equator, which in Carboniferous times passed through the coalfields of Europe and North America. But while the theory combines a number of facts remarkably well, it is an essential part of it that there should be no signs at all of glaciation in these northern coal-areas, and here we meet with some awkward features. Deposits supposed to be glacial have been noted both in Carboniferous and Devonian rocks in regions which Wegener places close to the equator; and although proof may be wanting in individual cases, their collective weight is considerable; for why should beds of a quasi-glacial character accumulate just at these horizons? But the crucial test case is that of the Squantum tillites near Boston U.S.A. (a tillite is a boulder-clay or " till " altered by pressure), for that has been widely accepted as unmistakeably glacial. Wegener, confident in his theory, declares that this cannot be the case; but the evidence seems so clear and convincing that unless very cogent reasons can be found for rejecting it, it must be regarded as definitely opposed to his hypothesis. It is important, too, to note that, on his own admission, the alternations of glacial and interglacial periods in the Pleistocene cannot be explained by changes in the polar position alone: while further objections, into which it is impossible to enter here, can be drawn from the geographical distribution of animals. But the theory is a very elastic one, capable of much alteration in detail, and it would be rash to assert that anything had yet been brought forward which made it definitely impossible.

We have now passed in brief review the principal hypotheses professing to account for Glacial Epochs, without finding one which is wholly satisfactory. Variations in the eccentricity of the earth's orbit, and in the quantity of volcanic dust in the atmosphere should probably be regarded as only minor influences, incapable by themselves of producing sufficient change; and although the solar heat undoubtedly varies to some extent, we are not at present justified in assuming all the variation required. Wegener's theory is weak in its foundations, since we have no certainty that the continents can move at all; and even if they do, there are many facts which are difficult to reconcile with it. Brooks's hypothesis is better in some ways, since the postulated changes in land and sea have undoubtedly occurred to a certain extent, but some meteorologists are unwilling to admit that these changes would be sufficient to account for the required degree of mildness in the climate of the Arctic and Antarctic circles.

It may well be that Glacial Epochs, which are rare, are due, not to any one cause, but to an exceptional combination of circumstances; but the evidence of fossils in the polar regions seems to point to a predominance of warmer conditions than the present; and until we can explain these, and the great fluctuations of temperature in the Pleistocene, we cannot claim to have solved the riddle of geological climates.

"Transformations of the Plant World."

By Dr. Dukinfield H. Scott, F.R.S.

Part I. Early Phases in the Geological History of Plants.

The geological record of plant-life shows a definite succession of phases of vegetation; the passage from one phase to the next generally appears to be abrupt, and may be called a Transformation.

Four great transformations may be recognised :—

1. From marine to terrestrial Flora. This was the most profound change of all. Its apparent date may be placed about the time of the Upper Silurian, but there may have been succes-

sive invasions from sea to land, going back to very early times.

2. From the earliest land Flora to the typical Palæozoic vegetation. Here there is much overlapping, but we may roughly place the geological date about the Middle Devonian.
3. From the Palæozoic to the Mesozoic type of Flora, a transformation so marked that it suggested to a high authority the idea of actual discontinuity. Time, from Permian to Trias.
4. From the typical Mesozoic Flora to the type of vegetation still persisting. This transformation, involving the sudden appearance of the true Flowering Plants, or Angiosperms, is, from a human point of view, the most important of all. Time, Cretaceous.

The idea of " discontinuous chains " does not contradict the theory of Evolution. What is suggested is the possibility of a fresh invasion from the sea, thus giving the land Flora a new start. The evidence is against anything of the kind (except at very early periods) and the suggestion is probably not seriously maintained.

Assuming continuity in the development of the land Flora, it is evident that the observed transformations are apparent, not real. The change in the general *facies* of the vegetation is real enough, but the origin of the new types must have lain much further back than the time of the conspicuous transformation.

" The Beginnings of Botany are in the Sea," as Dr. Church has told us. The oldest known plants are all seaweeds. Precambrian records, though much advertised, are doubtful. Only a few Cambrian Algae are known with any certainty, but when we come to the Ordovician there is a sudden burst of light. The work of Dr. von Pia of Vienna, has shown, from that time onwards, a succession of forms of highly organised Seaweeds, of the group Siphoneæ, remarkable for their non-cellular structure. Two Ordovician examples were shown in the slides, *Cyclocrinus* and *Mastopora,* each with a beautiful system of whorled branches. All these fossil Siphoneæ were calcareous, and thus well fitted for preservation. Professor Garwood has demonstrated their importance as Rock-builders.

A non-calcified genus, *Nematophycus* or *Nematophyton*, is well-known from Silurian and Early Devonian rocks. Specimens found by Sir William Dawson were as much as three feet in diameter.

FIRST TRANSFORMATION.

Our present knowledge of land-plants begins, somewhat doubtfully, with the Upper Silurian. A number of undoubted examples are known from the Lower Devonian. There is Dawson's genus *Psilophyton* with forked leafless stems, studded with thorns, and large terminal sporangia. The original account by the discoverer was probably substantially correct. The plants had a vascular axis for the conduction of water, and normal stomata in the epidermis, for the passage of gases. We have also a genus *Gosslingia,* newly discovered by Dr. Heard in the Lower Devonian of Brecon. Here there is a forked stem again, without leaves. The anatomy is well preserved; there is a large central strand of wood.

Arthrostigma, of like age, resembles an exaggerated *Psilophyton,* and also has a vascular structure. A very curious fossil, *Sporogonites,* discovered by Professor Halle in the Lower Devonian of Norway, resembles the fruit of a large moss, and in internal structure recalls especially the Bog Mosses (*Sphagnum*).

Our most detailed information as to the early land Flora comes from the Middle Devonian. The now famous fossils from the Chert-bed of Rhynie in Scotland, discovered by Mackie in 1913, and investigated by Kidston and Lang, show an unsurpassed perfection of preservation.

The Rhynias are absolutely simple plants, without leaves or roots, consisting of a naked branched stem, rising from a rhizome and bearing relatively large, terminal sporangia. In external form they are no more complex than a rather simple seaweed. Yet they were fully equipped for terrestrial life by the possession of a vascular system and stomata. It is remarkable that the oldest known land-plants have breathing-pores of typical structure. The stoma is one of the oldest and most conservative of plant-organs.

Hornea is as simple as *Rhynia,* but the rhizome is tuberous, and the spore-sacs, like those of *Sporogonites,* have the internal structure of the capsule of a Bog-moss. There are thus some indications that these early plants of the land united the characters of the *Pteridophytes* and *Bryophytes* (the Fern-allies and the Moss-allies).

Asteroxylon (" Star-wood ") is a decidedly more advanced type, with numerous small leaves, giving it the habit of a Club-moss. In various respects, however, the structure shows primitive features. The spore-sacs appear to have been borne on naked branches, at the summit. A German species, perhaps of slightly later date, since discovered at Elberfeld, by Kräusel and Weyland, shows the whole organisation very clearly, with the naked fertile branches springing from the leafy stem.

SECOND TRANSFORMATION.

In the Middle Devonian beds of Elberfeld we may perhaps recognise our second Transformation, for side by side with the still primitive *Asteroxylon,* several plants of very high organisation were discovered. One of these, named *Aneurophyton,* had the appearance of a Tree-fern, with large compound leaves, on some of which the spore-sacs were borne. The anatomy of the stem shows a highly developed wood, resembling in some respects that of the later Gymnosperms. This recalls Hugh Miller's "cone-bearing" tree, from the Middle Old Red Sandstone of Scotland. He had only the structure of the wood to go by, but he inferred, not without some justification, an affinity with the Conifers. In his "Footprints of the Creator," Hugh Miller used the early appearance of so highly organised a plant as an argument against the doctrine of Evolution, or Development, as it was called in his time (1847).

We must pass on rapidly. In the Upper Devonian the Second Transformation is complete, and the typical Palæozoic Flora well established. Naturally there were changes during the long period from the Upper Devonian to the Permian, but there was no great transformation.

In the Upper Devonian we have the magnificent "Ferns" of the genus *Archæopteris, A. hibernica* from Kiltorkan being the type species. The word "Fern" must be used with reserve, for it has been suggested that these fine plants may have been "Seed-bearing Ferns" and not true cryptogamic Ferns.

There were also great Club-moss trees (*Cyclostigma*) with large cones and two kinds of spore, as in the higher Lycopods of the present day.

The "Seed-ferns" (apart from more doubtful cases) were represented by the great American *Eospermatopteris*, demonstrated at a meeting of the Society last month. This is the oldest example of a Fern-like plant bearing "seeds."

Passing on to the Lower Carboniferous, we find ourselves in the presence of a rich Flora, representing Palæozoic vegetation in its purest manifestation. In the Victoria Park at Glasgow we can see the remains of a Lower Carboniferous forest *in situ*, studded with the stumps of great Lycopod trees. These ancient and gigantic Club-mosses were of very high organisation; some of them even produced a kind of seed, an organ not known among them after Palæozoic times.

In another group, distantly related to our Horse-tails, the cone of *Cheirostrobus* was the most elaborate cryptogamic fructification known, of any period, far exceeding any type now living.

The Seed-ferns (i.e., plants of fern-like habit, bearing true seeds of complex structure) were well represented. In one of them (*Thysanostesta,* from Spitzbergen) the seed bore a long hairy appendage, a kind of pappus, the earliest known example of this device, presumably facilitating seed-dispersal. Gymnospermous trees of huge stature were conspicuous; as may be seen at the Natural History Museum, where the trunk of the Craigleith Tree (*Pitys Withami*) is set up in the garden. Professor W. T. Gordon has recently discovered the leaves of *Pitys,* previously unknown; they somewhat resembled Pine-needles in form, but were quite different in structure.

The extraordinarily rich Flora of the Upper Carboniferous (including the Coal-measures) is too extensive and too well-known for any full account to be needed here. Great Tree-ferns abounded, probably of real cryptogamic nature, though this is disputed. Besides these, there were perhaps still more numerous Seed-ferns; an example, *Neuropteris heterophylla* was shown, bearing seeds the size of a hazel-nut. The important researches of Professor Halle on the Chinese Coal-flora, have revealed several new examples of this wholly extinct group.

The great trees, related to our modest Club-mosses and Horsetails, formed the bulk of the swampy forests. The trunk of a Club-moss, found by Mr. Lomax near Bolton, was 114 feet long before it began to branch, and another 25 feet or so above that point.

Among the Gymnosperms, the *Pitys* trees of the Lower Carboniferous were replaced by the Cordaiteæ, trees most nearly resembling in habit the Kauri (*Agathis*), of the Southern Hemisphere, but with far longer leaves. They bore catkins, enclosing stamens or seeds, quite different from the cones of our living Coniferæ.

Real Conifers, however, began to appear in the later days of the Upper Carboniferous. One genus, *Walchia*, has generally been referred to the Puzzle-monkies (*Araucaria*) but recent work points rather, perhaps, to an affinity with the Fir-trees, as is also the case with the Permian *Voltzia*.

So far the vegetation of the world appears to have been fairly uniform. Towards the end of our period, in the Permo-carboniferous, botanical districts became, for the first time, differentiated. While in the Northern regions the typical Carboniferous Flora persisted with little change, in India and the Southern Hemisphere a different vegetation made its appearance. This was the *Glossopteris* Flora, clothing the great Southern Continent of those days, known to geologists as Gondwana-land. The most characteristic genera, *Glossopteris* and *Gangamopteris,* possessed simple, Fern-like fronds, something like our Hartstongue. Whether they were true Ferns or Seed-ferns is unknown.

The great Club-mosses of the North were absent; the Horsetail allies were different. Our knowledge of the *Glossopteris* Flora is still very imperfect, but it evidently had a distinct character of its own. In some regions the Northern and Southern types overlapped.

It is probable that the appearance of the Gondwana-land Flora was associated with the vast Glaciation, about which we heard from Mr. Bury at a recent meeting. This Permian or Permo-carboniferous Ice Age appears to have been the greatest known to geologists. It must have had a profound effect on the vegetation of the whole Southern region of the Earth.

The lecture was illustrated by 54 lantern slides.

Part II. Later Phases in the Geological History of Plants.

THIRD TRANSFORMATION.

In the former lecture we sketched, in outline, the history of the Plant World from early times (not, of course, the beginning) to the end of the Palaeozoic age. We thus surveyed two transformations, that from sea to land and that from the primitive land Flora to the rich vegetation of the later Palaeozoic.

We now come to our third transformation, in which the typical Palaeozoic Flora was replaced by the extremely different Mesozoic vegetation. This great change has acquired an almost sensational interest from the suggestion, once made on high authority, that the evolution of the land Flora may have been discontinuous, new types being introduced by fresh incursions from the sea. This bold hypothesis is hardly to be taken seriously, and I believe is no longer upheld by its author. The new types which appear as soon as the Mesozoic age opens, are highly organised land-plants, and could certainly have had no immediate relation to any form of marine vegetation.

The transformation, however, was really almost a complete one. The Seed-ferns and Cordaitean trees, so far as we know, disappeared, from the Trias onwards. The Club-mosses were no longer of tree-stature—few and modest representatives alone are found. The Horse-tail race began to approach the familiar type of our day, though there were some reminiscences of Calamite predecessors. The Ferns flourished exceedingly and were quite different from those of the preceding age, belonging to various modern families, though not usually to those now dominant.

The Seed-ferns were replaced by a multitude of plants resembling the small surviving family of the Cycads. The recent Cycads (perhaps 100 species in all) are plants showing a superficial likeness to Palms (with which they have nothing to do) and bearing a simple fructification, mostly of the cone form, but in the female *Cycas* consisting of leaf-like carpels borne directly on the main stem. A few fossils are known showing a close affinity with the living family, but the great majority of so-called Cycads of Mesozoic age were far more highly organised for reproductive purposes, bearing complex organs analogous to, though essentially different from, the angiospermous flower.

It has been calculated that two out of any five of the Mesozoic land-plants were "Cycads" in the wide sense, an astonishing proportion. The group remained dominant from the Rhaetic to the Lower Cretaceous, though changing in certain respects.

The Cordaitean trees were succeeded by true Conifers, for the most part not so very different from those of our own time. The Maidenhair Trees (Gingkoaceae), now reduced to a single species, were an important family in Mesozoic floras.

At the same time a wider change took place. The northern and southern territories of the late Palaeozoic lost their frontiers, and the vegetation of the world once more became, broadly speaking, uniform.

It is evident that so great a change in the plants of the world, must have been initiated long before the manifest transformation was accomplished. There are some indications of Mesozoic groups appearing while the Palaeozoic conditions still persisted. Foliage and even fructifications of a Cycadean character are known from Permo-carboniferous rocks. As already mentioned, true Conifers had appeared at any rate in the Upper Coal-measures, perhaps earlier.

In the Triassic period it is well known that desert conditions widely prevailed. This no doubt helps to account for the apparently sudden transformation of the Flora. The prevalent aridity would have extinguished most of the luxuriant vegetation of Permo-carboniferous times, and thus have given a chance to races, hitherto in the background, which found themselves better adapted to the new conditions; and when more genial times returned, it would be these races which increased and multiplied and replenished the earth. On such lines the clue to the third transformation may well be sought; we are by no means driven to any such violent assumption as that of a new invasion from the sea by a ready-made and advanced land Flora!

The typical Mesozoic Flora remained in possession from the Trias to the Lower Cretaceous. At that period Angiosperms began to be associated with the older groups; in the Upper Cretaceous they became dominant. We are anticipating, but the question suggested is whether we find, before the undoubted appearance of Flowering Plants, any previous indications of their advent. The Mesozoic Cycads, or rather Cycadeoids, have been regarded as themselves leading up to the Angiosperms, or at least as an allied line of descent. The chief argument is drawn from the arrangement of the parts of the flower, especially in the later Cycadeoids. On the outside is an envelope of bracts, which may be called a perianth. Then, within the bracts, comes a whorl of stamens. In the middle is the female receptacle, bearing the ovules. This is just the same arrangement as in the hermaphrodite flower of an ordinary Angiosperm. It is true that the essential organs are very different. The Cycadeoid stamens are far more complex than in any Angiosperm; the ovules or seeds are not enclosed in carpels, but are borne singly at the ends of long stalks, intermingled with sterile scales. Still, a general comparison is possible, and it is especially with flowers of the *Magnolia* type that an analogy has been sought. The Cycadeoid habit is not suggestive of an Angiosperm, but it has been pointed out that the long-stemmed Williamsonias of the older Mesozoic are less Cycad-like and more Magnolia-like than the later Cycadeoids. At any rate the discovery that the dominant Mesozoic race possessed organs which may fairly be called *flowers*, is, in itself significant.*

Dr. Wieland, the discoverer of the Cycadeoid flower, has recently written on the antiquity of Angiosperms, and rightly urges that they must be far older than the recognised remains show. But the definite evidence previous to the Lower Cretaceous is scanty. Dr. Wieland himself describes fossils, of Rhaetic age, resembling the fruits of an Ash-tree, but the resemblance may be illusory. Professor Seward has recorded from the Stonesfield Slate, of Middle Jurassic age, simple, ovate leaves, with reticulate venation, like the foliage of a Dicotyledon. The evidence is uncertain, for there are Ferns, such as *Drymoglossum*, with fronds somewhat similar, but the appearance is at least suggestive of dicotyledonous affinities.

Much the most important evidence of early Angiosperms is Dr. Hamshaw Thomas's discovery of the Caytoniales, first found in the Lower Oolite of Yorkshire, and since recorded from Sardinia and elsewhere. The fructifications, referred to two new genera, *Caytonia* and *Gristhorpia*, consist of round fruits borne in two rows on a stalk. Each fruit is closed and contains a number of seeds; thus the structure was undoubtedly angiospermous in the literal sense of the word. Associated with the fruits Dr. Thomas found branched stamens bearing 4-lobed anthers perhaps comparable to those typical of existing Angiosperms. The vegetative organs attributed to these plants are compound, palmate leaves, previously known as *Sagenopteris*. Dr. Thomas gives good reasons for believing that all these remains belonged to the Caytoniales. His discovery manifestly throws a new light on the early history of the Angiosperms, though the relation of his fossils to the main line of descent is still an open question.

FOURTH TRANSFORMATION.

Apart from the few precursors, or possible precursors, just mentioned, the appearance of true Angiosperms dates from the Lower Cretaceous. This marks the beginning of our fourth transformation, which ushered in the reign of the Flowering Plants, the modern type of vegetation. From our own point of view this was by far the most important transformation of all, for it brought in practically all the plants which we use for food. It was the advent of the Flowering Plants which made the life of the higher Mammals and of Man possible.

We know that the transformation was really well advanced in Lower Cretaceous times, for Dr. Marie Stopes has described, from the Lower Greensand of England, several well-preserved dicotyledonous woody stems, with a structure as varied and as complex as that of our present-day trees. There is nothing at all primitive about these earliest known Dicotyledons.

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* It may be added that the ripe fruit of various Cycadeoids contains well-preserved embryos with two cotyledons, each embryo filling practically the whole interior of the seed.

The Lower Cretaceous Angiosperms were contemporary and associated with the old Mesozoic flora, which indeed was then still predominant. Professor Seward found, in the Cretaceous of Greenland, the leaf of a Plane-tree and that of an old-world Cycad, on opposite faces of the same slab of rock. In the period of the Gault and Upper Cretaceous the Flowering Plants had gained the upper hand, but some of the old types still lived on. In fact the largest and most complex Cycadeoid fruit known is of the age of the Gault.

In the Upper Cretaceous both Monocotyledons and Dicotyledons are represented, in about the same proportions as at the present day. The fossil evidence in no way helps, so far, to solve the question which class was the more primitive. The great family of the Palms is well attested, by fruits, leaves and wood; the latter shows just the same minute structure as in recent Palms. Reeds, Bur-reeds (*Sparganium*) and Lilies are also represented; Dr. Marie Stopes and Professor Fujii, have described a petrified flower, from the Upper Cretaceous of Japan (*Cretovarium japonicum*) with a trilocular ovary, like that of the Liliaceae.

Among the Dicotyledonous families of Cretaceous age are the following: the Willows and Poplars, the Walnuts, the Beeches, the Oaks, the Bread-fruit (found, strange to say, in Greenland !), the Water-lilies, the Laurels, the Witch-hazels, the Planes, the Maples, the Gum-trees (*Eucalyptus*), the Ebonies, the Ashes, the Dogbanes, and the Guelder-Roses.

The evidence in fact suggests that in Upper Cretaceous times the Flowering Plants were already developed very much as they are now, so far as the families and even some genera are concerned. It has been well said that " We are still living in the Cretaceous Epoch!" We are almost without a clue to what Darwin called the " abominable mystery " of the sudden appearance of the higher plants. As we have seen, there are just a few indications of Angiosperms in older rocks, but nothing as yet to throw any clear light on their origin.

Here we must leave our series of Transformations. We have shown that the " succession of dynasties " is the most striking feature in the past history of the Plant-Kingdom. We have little to show how these successive revolutions were accomplished. That each new dynasty arose long before it became dominant is manifest, and we have sometimes found direct evidence of precursors in an age previous to the obvious transformation of the Flora. But much remains to be done before we can hope to trace the course of descent from one period to the next, or to join up the so-called " discontinuous chains " of evolution.

The lecture was illustrated by 50 lantern slides, the three last slides showing portraits of three great leaders in the investigation of extinct plants, Renault in France, Binney and Williamson in England.

Practical Illustrations of some Properties of Wave Motion.

Abstract of a Lecture by MR. R. M. CLARK, M.C., B.Sc.

(All the Experiments here described were actually performed during the course of the lecture.)

The study of waves in all kinds of media has, for a long time, formed an important branch of Physics, and of particular importance has been the Wave Theory of Light, as propounded by Huyghens in the seventeenth century and later developed by Fresnel, Young, Stokes and Maxwell. The theoretical and practical support accorded to the more recent Quantum Theory of Radiation, which seemed, in essence, to be fundamentally opposed at most points to the Wave Theory, has led to the development of the science of Wave Mechanics as a means of reconciling the two ideas of transmission of energy by a continuous wave-train on the one hand and by discontinuous emission on the other.

OSCILLATING LATHS EXPERIMENT.

Waves are transmitted from point to point on account of the oscillations induced in the particles at those points, so that the first thing to consider is the motion of a single oscillating particle.

Although a wave may progress forward, this does not imply forward movement of the particles, which retain their same average positions. To demonstrate this, a set of one or two dozen similar wooden laths can be hung by their ends from a rod and all withdrawn equally to one side by another rod. If released one after the other, in fairly quick succession, they will oscillate with a " time lag " between neighbouring laths, and the whole set will be seen to give the impression of a wave.

RIPPLE TANK EXPERIMENT.

Except for large waves on the surface of water it is usually difficult, because of their speed, to observe the actual behaviour of progressive waves. If, however, ripples are produced on the surface of a fluid, such as mercury or water, by a vibrating source, and these ripples are viewed by an intermittent illumination which is interrupted at the same rate as that of vibration of the source, then the ripples will appear stationary and their action under various conditions may be studied. A suitable Ripple Tank for this purpose consists of a sheet of thin plate glass mounted in a water-tight frame and supported above the ground, with a lamp below throwing a strong beam up through the tank on to the ceiling. Water is put into the tank to the depth of about an inch, and by means of an electric motor small oscillations of the end of a rod can be used to set up circular ripples, or, if a straight edge is used, " plane waves." The motor also drives a disc with an aperture in it which interrupts the light in synchronism with the vibrations. Reflection of the ripples can be studied by means of straight or curved strips placed in the water.

The effect of Refraction can be produced by a glass plate so placed as to make the water shallow, hence reducing the velocity of the waves and altering the direction of propagation. A Ripple Tank has been used at the National Physical Laboratory for studying the probable acoustic properties of proposed buildings, by using sectional models, and by taking photographs showing the effects of the shape on the distribution of the waves after reflection from the walls.

STATIONARY WAVES. VIBRATING WIRE EXPERIMENT.

A method of maintaining a wire in constant vibration is to pass an alternating current through it and at the same time arrange the two poles of an electro-magnet to apply a strong magnetic field across the wire. When suitably adjusted the wire will vibrate continuously, setting itself in a succession of loops and nodes, and if the current be right it can be made red-hot at the nodes ; but not at the loops, owing to the cooling effect of their motion.

AN EFFECT OF WAVES IN BOURNEMOUTH BAY.

An interesting local example of one effect of sea-waves is to be found in the occurrence of regularly-spaced piles of pebbles along the beach in Bournemouth Bay, more noticeably to the West side of Alum Chine. These may be very clearly seen at times, and from the top of the Cliffs the regularity is striking. The spacing varies from about ten yards to forty yards on different occasions ; sometimes the height of each heap is as much as two feet, with the space between quite free of pebbles. The conditions which favour the formation appear to be a regular succession of long waves such as result from a North Wind, the choppy irregular waves which are produced when the wind is " on shore " do not seem to be effective. A single tide may produce a set of such piles of stones, and it is possible to see, at the same time, several series of such heaps formed by different tides at different levels along the beach. The following explanation is advanced for these formations :—

The action is, to some extent, one of automatic resonance of " tuning," as it can be observed that each returning or spent wave just exhausts itself under the next advancing wave when the formation is in process. The spacing of the groups of pebbles must depend on the time between successive waves and on the slope of the beach, since for different slopes the time of return of each spent wave will vary, and will only adjust itself to the time between waves by adjusting the volume of water in each of the sections into which the long regular waves break. This volume of water returns at the centre of the section, with high velocity at the last, so that it holds up the middle point of the next advancing wave and causes the wave-front to bend into two portions which face inwards on each side of the middle. When these two portions meet and break, the water heaps up at the middle and advances most prominently there, carrying stones with it. As it sweeps round to either side and loses impetus it drops most of the stones, forming the heaps at the sides of each section. As it returns down the beach it sucks all remaining stones down with it, leaving the beach clear in the middle. If it returns at the right time to delay the middle of the next wave in the same way the whole process repeats cumulatively; if not, there is no regularity to be observed. A similar phenomenon may also be seen on the shingle-bank to the East of Milford-on-Sea, and here the formation is remarkably pronounced, as the height of the shingle heaps may amount to six feet, although in this case there are no sand-patches between. Some reference to such groupings has been made in a letter to " Nature "; but it appears that on the whole they have received little attention.

Combs Ditch and Bokerley Dyke Reviewed

By Heywood Sumner, F.S.A.

First as to this name—Combs ditch. The prefix does not appear to be derived from O. E. *Cumb*, a valley, indeed its upland course belies such derivation.

Hutchins says in his " History of the County of Dorset," 3rd Edition, 1861, Vol. I, p. 160: " This Hundred (of Combs ditch) anciently called *Conkesdike* and *Cunkesdike,* in Rotuli Nonarum *Conkesdyck*, and in Inquisitio Gheldi *Concresdic*, takes its name from the great ditch that runs North of Whitchurch, Kingston and Anderson, where the courts were formerly held." Eyton, in " A Key to Domesday, Dorset Survey," p. 143, enters *Concresdic* Hundred as having the King, Jure Coronae, the seigneural Lord of the Hundred. O.N. *Konung,* King's dic, whence the later Combs ditch Hundred name.

The choice of the pre-Domesday name of Concresdic, for the name of this Hundred, implies that when Domesday was compiled, circa 1084 A.D., Concresdic was regarded as an ancient notable landmark.

After such place-name preamble I want to draw your attention to-day to this great, continuous bank-and-ditch barrier earthwork, which—although accurately shewn in the Ordnance Survey 6 inch sheets, Dorset XXXIII, N.W. and XXXIII, N.E.—has not received much field work examination by archaeologists, judging from past references to Combs ditch.

Leland, who in Henry VIII's reign made his "Laborious Journey and Serches for Englandes Antiquitees," thus vaguely refers to it: "Master Feelde told me that there rennithe a mighty longe Diche from . . . toward Lichet Maletravres in Dorsetshire," 3rd Edition, 1769, Vol. VII. fol. 19.

Aubrey, (1625-1697),) records in a Journal preserved in the Bodleian Library, "beyond Blandford towards Dorchester is another like . . . having the Groff (ditch) also Eastward."

Stukeley, on his way from Blandford to Dorchester, says: "About 3 miles beyond this (Blandford) I found another ditch and rampart which I believe to be the first of the colony of the Belgae; it has indeed a rude ancient look." "Itinerarium Curiosum," 2nd Edition, 1776, Vol. I, p. 189, (1st Edition, 1724). He also seems to refer to Combs ditch (though neither by name, nor with topographical detail), when he writes of "the first of the Belgic boundaries," South West of Blandford, made by the Belgae, advancing from the South in their invasion of Britain—Bokerly Dyke being the second, and so on, "Stonehenge," 1740, p. 4.

Dr. Guest further elaborated this Belgic theory of Combs ditch origin, in a paper read at the Archaeological Institute Meeting at Oxford, 1850, which he amplified in "Origines Celticae," Vol. II, p. 200, "The Belgic Ditches" but without any field work observation of the then present condition, and traceable course of this earthwork.

William Shipp also supported this theory in the 3rd Edition Hutchins' "History of Dorset," Vol. I. p. 192, and gives the fullest account that we have of the course of Combs ditch. He extends its course farther to the South East than is now apparent—which extension will be considered later on.

Charles Warne vigourously opposed the "Belgic Ditches" theory, in "Ancient Dorset," 1872, p. 300, et seq. and expressed his belief concerning the purpose of Bokerly Dyke (16 miles distant N.E. from, and comparing with, Combs ditch), as follows, "it may, and we believe it to have been a military work, constructed against impending invasion, and raised at a much later era than when the Belgae were dominant in its neighbourhood"—a belief that in 1892 was remarkably confirmed by General Pitt Rivers' excavations in Bokerly Dyke, near Woodyates. From the evidence of coins found on the old surface line beneath the rampart, he says "the Dyke is now proved to have been thrown up no earlier than the reign of Honorius, A.D. 395-423, and possibly by the Romanized Britons against the Saxons." "Excavations in Bokerly Dyke," Vol. III, p. 20. General Pitt Rivers also briefly alludes to Dr. Guest's "Belgic Ditches" theory—but dismisses it as "most improbable." Op. cit., p. 2.

Such are the scanty references to Combs ditch made by antiquaries in the past. I think that this earthwork is worthy of closer study than it has hitherto received, in view of its comparative resemblance to Bokerly Dyke; and hope that the following descriptive survey of the course, and present condition of Combs ditch may help to explain its probable origin and purpose—a tentative explanation that can only be confirmed, or refuted, by excavation in the right place, i.e. near the latest prehistoric habitation site that this earthwork passes in its course—such (for example) as existed near Woodyates, where General Pitt Rivers made his excavations in Bokerly Dyke.

The first qualification needful for making such survey is to understand the lie of the land on which this Combs ditch earthwork was thrown up. The great Dorset chalk escarpment that dominates Blackmore Vale towards the North West, and rises to 902 feet at Bulbarrow, is about 4 miles distant from the begining of Combs ditch on a remnant of Whatcombe down. The lie of the Dorset chalk escarpment is abrupt on the North Western side, and gradual on the South Eastern. Here, its gradual slope is ridged by long, blunt, chalk hills, and furrowed by long, shallow, dry valleys that trend downwards to the Stour, and to the Winterborne. It is a wind-swept tract of land—as the wind-screen belts of trees testify around Charisworth—that culminates 3¼ miles from Blandford along the high road to Dorchester, in a broad ridge running from North-West to South-East, rising to 409 feet on Charlton Down, thence falling gradually to 356 feet in Great Coll Wood; and it is on this broad upland ridge that mainly lies the course of Combs ditch.

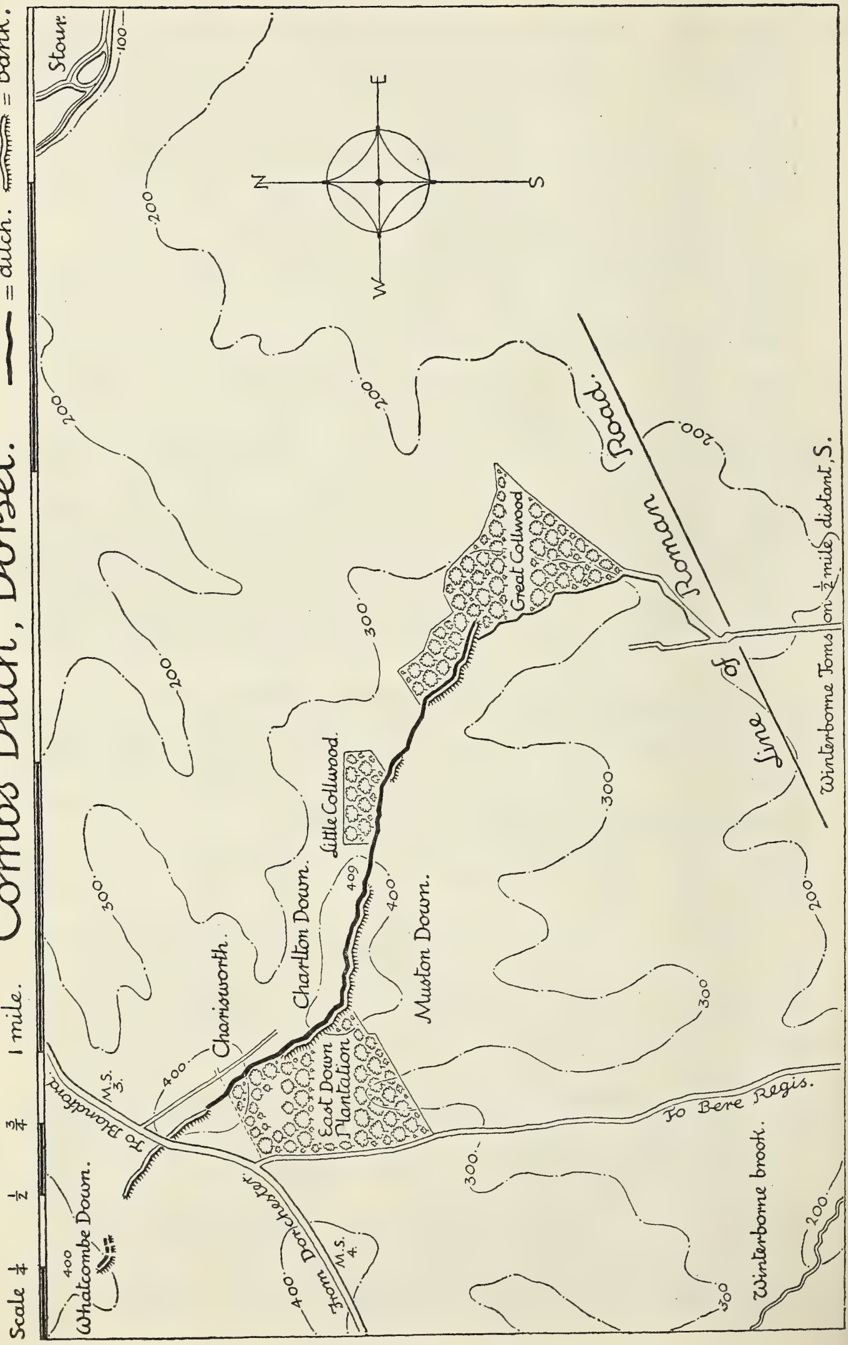
The said high-road (made in 1756) crosses these chalk hills and dry valleys, the former through cuttings, the latter across embankments. If this road is followed for 3¼ miles from Blandford, the rampart bank of Combs ditch may be seen on high (400 feet), level ground, running at right-angles on the left-hand side of the high-road—bounding two arable fields.

In the North-Eastern arable field the ditch has been ploughed out, and filled in, and now appears as a slope slanting downward towards the bank.

Measuring the earthwork here, from South-West to North-East, the overall of bank and ploughed out ditch is 68 feet. From present field level to bank crest, 4 feet vertical. From bank crest to present bottom of ploughed out and filled in ditch, 7 feet vertical, downward. Thence, to the top of the slope, 42 feet horizontal, 4 feet vertical.

On the right-hand side of the high-road (coming from Blandford) the bank of Combs ditch is less eminent, and the ploughed out ditch-slope less wide; but they can both be traced continuously (with one break) for half a mile to Whatcombe down, where both bank and ditch reappear—but cut about by farm-cart traffic and overgrown by furze brakes. Here, on the Western verge of this relic strip of Whatcombe down, Combs ditch begins its zig-zag course of about 2¾ miles. There are no signs of its continuation on any of the adjoining fields, or field bound-

Combs Ditch, Dorset.



aries—such as exist on the Western verge of Great Coll wood described below.

I think that we may assume from present surface evidence, that Whatcombe down marks the beginning of Combs ditch; so let us return to the high-road and follow the course of this earthwork towards the South-East.

Here the rampart bank, with the ditch ploughed out, of which the measurement has been given above, runs for 240 yards; and then, destruction is inverted—the ditch remains, but the bank has been ploughed out, and the earthwork thus continues for about 630 yards, when it enters East Down Plantation, and then a rabbit-riddled, overgrown bank and ditch re-appear, and connect with the footpath profile subsequently measured. The profiles of bank and ditch are here very erratic, owing to woodland growth, either planted or self-sown; and to ferretting, rabbit-hole diggings, and rabbit scrapes.

On the North-Western verge of Charlton down there is a footpath that crosses Combs ditch at right-angle, leading to a newly-built cottage in East Down Plantation, just inside the wood. Here the profile of both bank and ditch can be measured without much woodland obstruction. The overall of the earthwork is about 86 feet. Measuring from South-West to North-East, the height of the bank from base to crest is 5 feet vertical; from bank crest to ditch bottom, 9 feet vertical downwards; ditch bottom 6 feet horizontal; from ditch bottom to crest of counterscarp bank, 6 feet vertical; and from crest of counterscarp to down level, 2 feet downward vertical.

The large width of the ditch bottom suggests that it has been much filled in by the waste of the rampart and counterscarp banks, and that when Combs ditch was originally thrown up, it must have been a formidable obstacle here.

Hence, onward towards the South-East, bank and ditch continue, just inside the wood for about 300 yards, densely overgrown—until they emerge on open downland; Charlton down on the North-East; Muston down on the South-West.

Across this upland (the highest benchmark is 409 feet above the sea) the course of Combs ditch may be seen at its best; for half a mile it zig-zags across the hill-top, here, in the open, there, amid furze brakes and thickets that give shelter on these wind-whistling downs. Self-sown thorns, elders, wayfarer's trees and privet bushes grow luxuriantly in the deep soil of the ditch, while coarse grass, here, as elsewhere, has in places supplanted the down sward. Mr. L. Beeching Hall tells me that this coarse grass is Brachypodium pinnatum, sometimes called "False Brome." Locally, I found that it was called "Dredge" grass. *Dryge*, O.E. dry—which well describes this wiry, uneatable grass —"that cuts your hand, if you pluck it," as I was told by my local informer.

On either side the land falls for miles, gradually, and then rises and falls, again and again, across Stour valley and Cranborne Chase to the East, and Dorset lowlands and sea-coast hills to the West, till far distance merges into cloudy horizon. Indeed, this upland site dominates a spacious panorama, and stray pleasures of vision await the plodding antiquary who seeks to follow the course of Combs ditch.

The measurements of the earthwork are rather less here than those last recorded, e.g., overall—bank, ditch and counterscarp, 78 feet. Measuring South-West to North-East, the height of the bank from base to crest is 4 feet vertical; from bank crest to ditch bottom, 8 feet 6 inches vertical, downward; ditch bottom, 5 feet horizontal; from ditch bottom to crest of counterscarp bank, 6 feet vertical; and from crest of counterscarp bank to down level, 3 feet vertical, downward.

The zig-zag lay-out of Combs ditch is apparent throughout the 2¾ miles of its course, and specially here, where it crosses open downland, and where it has been undisturbed either by cultivation or tree-planting. In spite of the elemental waste of centuries this downland length of Combs ditch retains—like fragmentary classic sculpture—the authentic touch of original creation.

Such zig-zag may suggest hasty, emergency digging along a given line or direction—by separate gangs—each digging a length of ditch and throwing up a corresponding bank, without marking out—then finally joining up deviations at each end.

Or, such zig-zag course may represent the ditch-diggers' avoidance of thorns, elders, etc., then growing here on the intended lines of Combs ditch when it was then a project—a project to stay the oncoming West Saxon invasion in the 6th Century A.D.

There appears to be some comparative resemblance to such zig-zag course in parts of Bokerly Dyke, and of Grims ditch (the latter being probably of earlier date, cf. "Ancient Earthworks of Cranborne Chase," by the writer, Plates XXXIII and XXXIV).

The air photographs in "Wessex from the Air," by O. G. S. Crawford and Alexander Keiller, admirably show the *wavy* course of prehistoric camp earthworks, and the *precise* course of Roman earthworks (cf. Plates I and XLIX), both of which differ entirely from the zig-zag course of Combs ditch.

After leaving the open stretch of Charlton down the land falls gradually towards the South-East, South-West, and West. Combs ditch now becomes a boundary between downland jungle growth and arable land, with its bank much reduced by the plough; then it follows the South-Western verge of a young larch plantation on "No Man's Land," where the bank has been completely ploughed out and spread, leaving no trace of its having ever existed; then it follows the South-Western verge of Little Coll wood for about 450 yards; here the ditch has been partly filled in, and is concealed by planted underwood, while the bank has been almost entirely ploughed out. At the South-Western corner of Little Coll wood both bank and ditch are fairly well preserved for a length of 75 yards, crossing arable land; after which only the ditch remains, riddled with rabbit burrows, and overgrown with elders, privet-bushes, brambles and coarse grass, the bank is entirely ploughed out and spread, and the ditch has been partly filled in. The ditch thus crosses arable land for a length of 360 yards, when it reaches Great Coll wood.

This length of the course of Combs ditch, and those along the verge of No Man's Land, and Little Coll wood are specially instructive as they show how completely the bank may disappear, when spread by the plough in this clay-with-flints chalk soil, and suggest that the disappearance of William Shipp's prolongation of Combs ditch to Winterborne Tomson (subsequently reviewed) may be due to its having been ploughed out in like manner.

When Combs ditch reaches the North-Western corner of Great Coll wood it follows the Western verge of the wood, with both bank and ditch in fair preservation, but concealed by planted woodland growth, and thus continues for about 440 yards, when it enters the wood, pursuing a straighter course for about 200 yards—and then stops.

Measuring the earthwork within Great Coll wood, from South-West to North-East, the overall of bank and ditch is 57 feet; height of bank from base to crest, 3 feet vertical; from bank crest to ditch bottom, 7 feet vertical, downward; ditch bottom, 3 feet horizontal; from ditch to top edge of counterscarp, 5 feet vertical. There is no counterscarp bank here.

The above measurements show a diminution in this earthwork as it gradually descends from about 400 feet on Charlton down, to about 350 feet in Great Coll wood.

Having now traced the existing course of Combs ditch from its beginning on Whatcombe down to its apparent end in Great Coll wood, I return to further consideration of William Shipp's record of its course (mentioned above) along and beyond Great Coll wood, premising that he was a keen, mid-Victorian archæologist who lived at Blandford, and knew his surrounding district well and truly. His regard of the lower end of Combs ditch cannot lightly be dismissed, and is still, after the lapse of more than 70 years of ploughing changes and chances, supported by certain zig-zag ditch remains subsequently described. He thus records its course here:

" . . . it passes along the crest of the down (Charlton) to Great Colwood, bounding the wood on the Western side, and then descends into the Winterborne valley, where all traces of it cease a little to the East of Thomson " (now known as Winterborne Tomson).

Evidence of such extension may now be found on the South-Western side of the 200-yard length of Combs ditch which enters Great Coll wood as beforesaid. Here the bank of William Shipp's extension joins the bank of the Ordnance Survey termination length. It is consolidated, much wasted, and the ditch is silted up, it measures approximately 40 feet overall, with 3 feet 6 inches bank height above ditch bottom. If the ride is followed that leads from here, to the South-Western exit from Great Coll wood (about ¾ mile distant), ploughed out remains of what appears to be this Combs ditch extension may be seen in winter or early spring, in the zig-zag woodland verge that flanks this ride continuously on its Western side.

It should be noted that at the above-mentioned junction of William Shipp's extended course of Combs ditch with the Ordnance Survey termination length, the latter is crossed by a woodland bank, that is not consolidated like Combs bank and much narrower—this continues to the North-East and appears to have been at some time the Northern boundary of Great Coll wood.

At the South-Western corner exit from Great Coll wood a disused lane, flanked on its Western side by a zig-zag, silted up ditch and hedgerow, leads down to a cart-road that comes up from the Winterborne valley. Close to this meeting-point of lane and cart-road lies the line of the Roman road from old Sarum to Dorchester, here obliterated by cultivation, but traceable on arable land by a continuous strip-spread of large flints that contrasts with the normal surrounding upturn of small flints. Beyond this Roman road line, to the South-East, there is, now, no earthwork evidence of Combs ditch apparent.

The zig-zag Western boundary of Great Coll wood, and of the ditched hedgerow mentioned above, are different from any usual chalkland delimitation—specially as regards the ditch. In such soil ditches are not, and never have been wanted for agricultural purpose, owing to the absorbent nature of chalk. The ditches that we may now find on chalk uplands were made in prehistoric times, (1) either for bank and ditch defence, (2) or for bank and ditch boundary mark, perhaps tribal, (3) or for bank and ditch cattle-stops, to facilitate hasty cattle drifts to a camp of safety against raiders, (4) or with ditch between banks on either side, for single way, cattle drifts into cattle enclosures. Possibly this zig-zag boundary of the Western side of Great Coll wood, and the silted up ditch bounding the zig-zag hedgerow, mark the course of a ploughed out extension of Combs ditch to command the Roman road; if so, it may be compared with the similar extension of Bokerly Dyke, apparently for a similar purpose. General Pitt Rivers' excavations in this earthwork showed that it originally ended a quarter of a mile distant East from the high road; at a South-West return of about 90 yards from the prevailing North-East line of the Dyke—which return he called " The Epaulement "—and that the extension of Bokerly Dyke to the North-West of the Epaulement was probably more recent. (" Excavations in Bokerly Dyke," Vol. III, p. 58, et seq). It was in the latter portion of this earthwork that General Pitt

Rivers' excavations were principally made, namely, on either side of the Roman road from Old Sarum to Dorchester, and from the evidence thus obtained, he proved, as quoted above, " that the Dyke was thrown up no earlier than the reign of Honorius, A.D. 395-423, and possibly by the Romanized Britons against the Saxons " (op. cit. p. 20).

The choice of this site for excavation near Woodyates made such dating conclusive, as the land adjoining held evidence of the latest occupation. The following notes may help to explain datable value of finds in such excavation.

(1) If only Bronze Age relics were found beneath the old, undisturbed surface line under the rampart bank, but Bronze Age and Iron Age relics were found in the ground adjoining, this would be evidence of Iron Age occupation subsequent to Bronze Age occupation, and would date the rampart bank, *thrown up in the Bronze Age.*

(2) If only Bronze Age and Iron Age relics were found beneath the old, undisturbed surface line under the rampart bank, but Bronze Age, Iron Age, and Late Celtic relics were found in the ground adjoining, this would be evidence of Late Celtic occupation, subsequent to Bronze Age and Iron Age occupation, and would date the rampart bank, *thrown up in the Iron Age.*

(3) If only Bronze Age, Iron Age and Late Celtic relics were found beneath the old, undisturbed surface line under the rampart bank, but Bronze Age, Iron Age, Late Celtic, and Roman relics were found in the ground adjoining, this would be evidence of Roman occupation subsequent to Bronze Age, Iron Age, and Late Celtic occupation, and would date the rampart bank, *thrown up in Late Celtic period.*

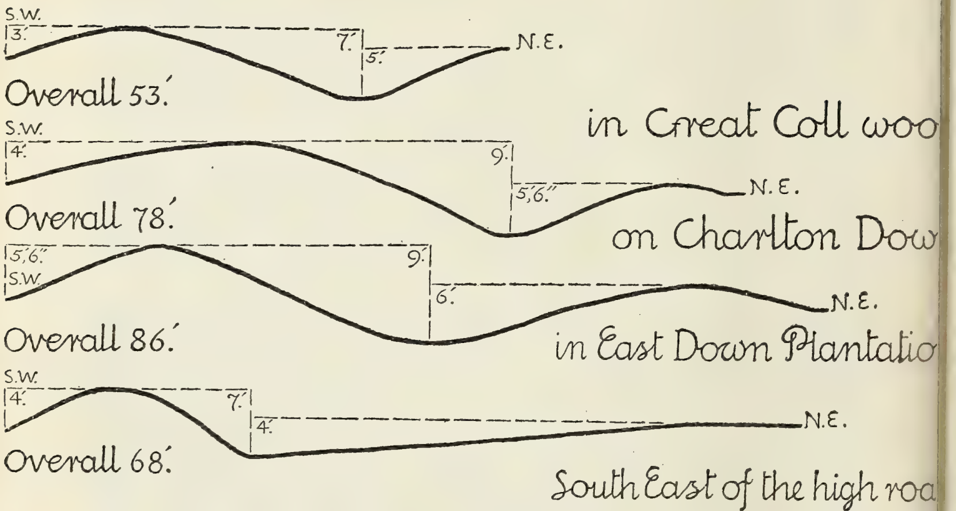
(4) If relics of all the above periods were found beneath the old, undisturbed surface line under the rampart bank, and also in the ground adjoining, this would date the rampart bank, *thrown up during, or after the Roman occupation.*

If attempt were made to date the original construction of Combs ditch by means of excavation, it would be essential that a place (for which I have looked in vain) should be discovered, where evidence exists near its course of the latest occupation, i.e. Roman. A hardy, archaeological caravanner is needed for such discovery, to take his stand on Charlton down, in early spring when undergrowth is still bare, and then to fossick up, down, and along the bank and ditch of Combs ditch, wherever rabbit holes and scrapes, and molehills may be found.

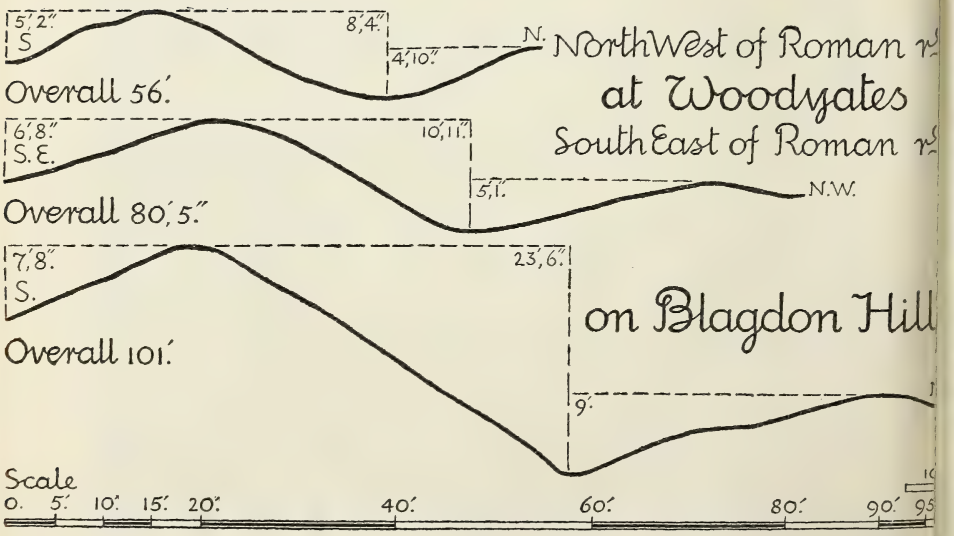
Alas that I am constrained, anno domini, merely to point.

From superficial survey it seems probable that Combs ditch was thrown up also by the Romanized Britons, for it compares in purpose, construction and course with Bokerly Dyke, 16 miles distant to the North East, and approximately parallel in course, namely : (1) in its purpose to oppose an enemy coming from the North East; (2) in its being a barrier across the upland way, and,

Profiles of Combs Ditch



Profiles of Bokerly Dyke



probably, across the Roman road to the West; (3) in its overall measurements, profiles, and zig-zag course in construction; (4) in its length—if William Shipp's record, and present-day surface survey suggestion be accepted.

The comparative lengths of the two earthworks, are as follows: *Combs ditch,* about 2¾ miles—from Whatcombe down, to present apparent ending in Great Coll wood—and about 3¾ miles, if it originally extended to the Roman road, near Winterborne Tomson. *Bokerly Dyke*, about 4 miles—from near West Woodyates Manor, to Martin wood.

Now I want to draw your attention to the diagrams that illustrate my lecture, with special comparison between two profiles of Combs ditch—Near East down, and Charlton down—and two profiles of Bokerly Dyke, near Woodyates.

It will be seen that Combs ditch was thrown up along the central axis of a broad, upland ridge that trends gradually downward from North West to South East. There is now no natural flank defence at the beginning of its course on Whatcombe down. Possibly when this earthwork was originally thrown up, it was flanked by woodland here. If so, a stockade of felled trees would have formed effective obstruction. We have had recent experience of the barrier presented by trees uprooted and fallen across roads in the great hurricane of January 12th, 1930; and of the difficulty of clearing such obstructed roads, even with good-will on both sides. We can imagine how formidable must have been the obstacle presented by such barricade of felled trees, trunks and tangled tree-tops, guarded by ill-will on the further side—by the Romanized Britons fighting for existence against the Saxons.

The Western extension of Bokerly Dyke begins on similar terrain to that on which Combs ditch begins, both in altitude, and in being now open upland, mostly under cultivation. Possibly here also barricades of felled trees completed the earthwork barrier as described above. Its course subsequently is over terrain different from that of Combs ditch, for it crosses a high valley (300 feet) on Martin down, mounts Blagdon Hill (500 feet), follows the axis of a narrow ridge (400 feet) and finally ends on a knoll (500 feet) in Martin wood.

On the Northern base of Blagdon Hill, Bokerly Dyke crosses a water-parting between Avon and Stour tributaries. In wet winters, when the chalk subsoil is full of water, a head-spring rises just below the 300 feet contour line, and flows North East to join the Martin Allen brook, that in turn joins the Avon at Fordingbridge; while on the other side of this water-parting, the head-spring rises high up in the Pentridge valley, and flows South-West, to swell the Crane brook, that becomes the Moors river, and eventually joins the Stour near Hurn.

This water-parting, high valley between Martin and Pentridge, is now used as a down-way when the chalk springs are low.

Probably it was used in prehistoric times as a " summer-way." If so, such usage would account for the increase of bank and ditch defence of Bokerly Dyke here, as testified by present-day measurements.

Bokerly Dyke, crossing this water-parting col, and probable, prehistoric summer-way, has never been explored by excavation. It may be that beneath this down-land lies evidence of the unknown happenings here, in the middle of the sixth century, when the invading West Saxons made their successful advance, circa A.D. 553, which added West Britain to their kingdom.

This site needs an excavator for knowledge only; Museum specimens would probably not be up-turned, but only fragmentary evidence (at best) of both British and Saxon relics.

General Pitt Rivers' excavations in Bokerly Dyke and Wansdyke, and (more recently) Dr. Cyril Fox's excavations in the Cambridgeshire Dykes, and in the Welsh Marches, Offa's Dyke, are classic guides for method, and deduction in such excavations for knowledge.

We have no evidence either from the Anglo-Saxon Chronicle, or from excavation, to show what part these two barriers—Bokerly Dyke and Combs ditch—played in the struggle between the Romanized British inhabitants, and the invading West Saxons. We can only infer how stubborn had been the resistance of the British by the long pause after the battle of Cerdices-ford (Charford, near Downton) A.D. 519, when Saxon advance farther West was at a standstill for 33 years. Then the Anglo-Saxon Chronicle records as follows:—

" A.D. 552. This year Cynric fought against the Britons at the place which is called Searobyrig (Old Sarum) and he put the Britons to flight."

" A.D. 556. This year Cynric and Ceawlin fought the Britons at Berin Byrig " (Barbury? near Marlborough).

" A.D. 577. This year Cuthwine and Ceawlin fought against the Britons, and they slew three Kings—Comail, Condidan, and Farinmail, at the place which is called Deorham (Derham?), and took three cities from them—Gloucester, and Cirencester, and Bath."

We may assume that, during the above period of Saxon conquests in the West, this tract of Wessex was added to the West Saxon kingdom; that the Romano-British upland settlements were abandoned; and that the Saxons chose valley sites in their stead—choice which has been endorsed to the present day.

This assumption is confirmed by the numerous excavations that have been made and recorded in Cranborne Chase, which show that prehistoric occupation of upland sites here ceased when the Saxons invaded and occupied this part of Wessex.

The following extract from General Pitt Rivers' account of " Excavations in Bokerly Dyke," Vol. III, p. 7, explains the part played in prehistoric warfare by such continuous lines of ditch and bank barriers.

"Wherever we find isolated encampments on the tops of hills in prehistoric times we may be sure that they were simply places of refuge for some local tribe inhabiting their vicinity to which they resorted when attacked by a neighbouring tribe. They imply a low state of civilisation, before the inhabitants of any large district had attained to such organisation as was necessary for combined defence.

When the people advanced to a higher state of civilisation, and several tribes combined for the defence of a district, it was not by detached forts, but by continuous entrenchments, that they accomplished that object. They threw up continuous lines of ditch and bank, the latter probably surmounted by a stockade, running for miles across the open country, from an inaccessible position on one flank to some other natural defence on the other flank; and, although it may be true—as has often been said in support of the opinion that these long entrenchments could not be defensive works—that they would be difficult, or impossible, to defend at all points, yet we know as a fact that this was the system adopted, and that the Romans used it, not only against the Picts and Scots, but also in the more extended defence of their German frontier, by means of the Pfahlgraben, joining the Rhine and Danube."

We know that Cranborne Chase was crowded with open, Romanized British villages, while such occupation extended far to the West, and it was to defend this civilization that Bokerly Dyke, and presumably Combs ditch, were thrown up by the Romanized Britons.

It should be noted that Combs ditch nowhere attains to the size of Bokerly Dyke on and near Blagdon Hill, which rises to 500 feet in height—but this may be owing to its having been thrown up throughout its course on fairly level uplands—similar to the land around Woodyates, where the measurements and profiles of these two earthworks compare closely. Combs ditch moreover has been less fortunate than Bokerly Dyke in the preservation of the most formidable portion of its course, namely, that which stretches at right-angles to the high-road for a mile and a half towards the South-East—since it is here either partially ploughed out or hidden from view by woodland undergrowth.

Such being the case, the remains of Combs ditch may be passed unnoticed by the motorist on his speed-way from Dorchester to Blandford.

Not so those of Bokerly Dyke. The motorist who is speeding from Salisbury to Blandford will have a full view of the Dyke, as it zig-zags across the open folds of Martin down on the left, and up the steep slope of Blagdon Hill, about two miles distant. If he is wise, he will stop where the high-road traverses the Dyke line, near Woodyates, and will mount and follow afoot along the rampart bank-crest towards the South-East, whence he will gaze on the finest example of a continuous defensive earthwork that can now be seen in this part of South-Western Britain.

Bokerly Dyke may be regarded as an earthwork memorial of *Britain*—as opposed to *England*.

Bokerly Dyke is the Monument of a lost cause—and (I think) Combs ditch may likewise be thus remembered.

"Glass and Glass Making."

By Dr. G. E. J. Crallan, M.A., M.B., M.R.C.S.

In making "*plate-glass*" the glass is withdrawn from the tank by large ladles—holding as much as 180 to 200lbs. of glass. These are suspended from slings attached to overhead trolleys. The "ladler" dips the ladle into the molten glass, giving it a half turn so as to fill it as full as possible, lifts it out, and runs it along the trolley to the rolling table, and empties it just in front of the roller. The rolling table is a cast iron slab large enough to accommodate the largest sheet to be rolled. Over this slab a massive iron roller is moved by machinery. The thickness of the sheet to be rolled is regulated by means of slips of iron placed at the sides of the table. The width of the sheet is regulated by a pair of iron guides formed to fit the forward face of the roller and the surface of the table. The roller pushes these guides before it and the glass is confined between them. When the roller has passed over the glass, the sheet is left on the table in a red-hot soft condition. After cooling and hardening to a certain extent, it is loosened from the table by a flat-bladed iron tool. It is then removed on a stone slab to the annealing kiln or "Lear." This is sealed up and the glass allowed to cool gradually by the aid of a special air circulation for four or five days. When properly cooled, the sheets are carried to the cutting and sorting room, where they are trimmed and cut to size, after being carefully inspected as to quality or defects.

In impressing a pattern on plate glass, the pattern is engraved in intaglio on the roller, and is generally a simple pattern such as longitudinal ribbing or a lozenge.

The process of grinding and polishing plate-glass consists of three stages :—

1. The surface is ground with a coarse abrasive, to be as flat as possible. This leaves a rough grey surface.
2. The surface is then ground down with a finer abrasive till a smooth grey surface is left.
3. The final brilliant polish is produced by friction with rouge. These processes used to be done by hand, but now are effected by ingenious machines.

Before being ground and polished the plate is bedded in plaster of Paris. When one side is finished, the plate is removed from the setting, and laid on a bed of damp cloth, while the other side is treated. The plates of glass are ground on rotating tables, some of which are as much as 30 feet in diameter. The rubbers also are rotary, and consist of heavy iron slabs or wooden boxes shod with iron. The sand abrasive is fed on to the glass in the form of a thin paste. The polishing rubbers are large felt-covered slabs of wood or iron which are pressed forcibly against the glass; they are fed with a thin paste of rouge and water. On the average slabs of plate-glass lose $\frac{1}{3}$rd of their original weight in the grinding and polishing processes.

Plate-glass has been made up to 28ft. by 14ft., and in thickness from 3/16 inch to $1\frac{1}{2}$ inch for special purposes. Such large plates are used for glazing show windows of shops, etc. The bent plate-glass window panes are made by heating the glass after it is polished, and placing it gently when softened against a stone or metal mould of the desired curvature. This requires great care and absolute cleanliness and smoothness of the surface of the mould.

Opaque plate-glass, black or white, is used for " fascias " over shop fronts, counters and shelves of shops, and even tombstones. In order to prevent breakage of plate-glass windows or partitions, by fire or burglars, some manufacturers have introduced wire-netting into the glass. In the event of fire or a violent blow, though the glass will crack, the fragments will be held together by the wire net work, and the plate as a whole will remain in place.

Sheet glass is the lighter form of plate-glass such as is used for ordinary glazing. It is made in four qualities, which vary in weight from 15oz. to 42oz. per square foot.

1. For pictures, cabinets and special windows.
2. For public buildings, offices, residences, etc.
3. For conservatories, out-houses, railway and tramcars, boxes for electric batteries, shades, aquariums, etc.
4. For workshops, cottages, horticultural work.

A lighter form still is used for photographic plates, lantern slides, and microscope-slide covers. Sheet glass is prepared and melted in tanks. The process of manufacture is quite unlike the making of plate-glass, and is as follows :—

The molten glass is " gathered " by successive dippings on the end of a blow-pipe till it forms a mass about the size of a man's head. This " gather " is then shaped and carried by the blower to a stage where the glass is distended by blowing, and elongated by swinging. By repeated re-heating, blowing and swinging, a cylinder is produced uniform in thickness and diameter throughout. This cylinder, after being removed from the pipe and allowed to cool, is taken to the " splitting room," where the cylinders are carefully inspected for flaws. When passed as of good quality, they are split longitudinally, either by a hot iron, followed by slight moistening, or by a diamond drawn along the inner surface. They are then placed in the flattening kilns, where the heat softens the glass, thus enabling the workman to unroll them on to a perfectly flat bed on which they are smoothed down by a wooden polisher. The sheets are then passed down the cooling chamber to be annealed, and thence to the cutting room to be graded for quality, and cut to the requisite sizes.

Another method is by the drawing machine. At one end of a shed, and let in the ground, lie eight or ten crucibles containing the molten glass. Above is the mechanism by which a metal pipe or " bait " is lowered into the crucible. The glass adheres, and as the " bait " is raised the glass is drawn up with it. After the draw starts the cylinder is distended to the required diameter by the introduction of compressed air, which is regulated to keep the diameter constant. In this way a cylinder 40 feet in height, and uniform in diameter and thickness, is obtained. By this time the glass is set and shining as it appears in windows. The cylinders are then neatly severed from the crucibles and lowered by pulleys and ropes on rests which stand in front to receive them. They are then taken to the " splitting room " and treated as already said.

Coloured glass is used extensively for signal lamps on railways, lights on various vehicles, on harbour lights and lighthouses, also in photography, in public buildings and houses, and in ecclesiastical buildings. The colouring substance in glass may be roughly divided into two kinds. The first and largest kind are those bodies which occur in glass in true solution, the element being present as a silicate or some other compound which is soluble in the glass. The second kind are probably present in the glass in a state of very fine division, in a sort of suspension, approximating to what is known as " colloidal solution." The range of colours and tints is practically unlimited. In the case of powerful colouring materials, such as ruby and blue, the desired tint is obtained by a process called " flashing." A pot of molten coloured glass is arranged close to a pot containing molten colourless glass. A small gathering of the coloured glass is first taken on the blow-pipe, and the remaining gatherings required are taken from the colourless glass. When this combined gathering is blown into a globe or cylinder, the coloured glass lies as a thin layer over the inner surface.

The artist in stained glass has a further range of colours at his disposal in the form of stains and transparent colours, which can be applied to the surface of the glass and be developed and rendered more or less permanent by being properly " fired."

It is a curious fact that the technically excellent coloured glass of modern times is less adapted for church windows than the old stained glass. The art was for a time considered a " lost art," but careful study has shown that the difference lay in the fact that the modern glass was practically free from defects. Now a perfect piece of glass, having smooth surfaces and no internal irregularities, allows the rays of light to pass through undeflected and merely changed in colour according to the tint of glass. External objects can be seen, and much of the interest and mystery of the glass is lost. On the other hand when falling on glass with an irregular surface and containing all sorts of defects such as striæ, bubbles, and even pieces of enclosed solid matter, the light is scattered, refracted and deflected in all directions, till it almost appears to emanate from the body of the glass itself as if it had an internal light of its own, and external objects can scarcely be perceived. This defective structure of the old glass is now imitated by using rolled glass and introducing striæ, bubbles, etc., to produce the required effect.

Cathedral glass of various patterns is much used for glazing windows which have an unpleasing outlook. This glass eliminates the view without lessening the amount of light, and if cathedral vita glass is used the light is actually increased and improved. Much cathedral glass is now wired, so that wire-netting outside, which used to cut off a lot of light, and had to be moved when the church windows were cleaned, is no longer required. The church windows are thus protected in case of fire or violence.

Optical glass. The manufacture of this kind of glass presents some of the most difficult problems the glass manufacturer has to deal with. A high degree of purity, transparency, and durability is necessary. The process of annealing requires the greatest care and judgment. It is a difficult matter to get pieces of optical glass only a few inches in diameter, of the right optical constant and refractive index, that are homogeneous enough to allow the light rays passing without some dispersion when set up for use. It frequently becomes necessary to achromatise one glass with another in the form of doublets to correct aberration. No decolorisers or impure materials are permissible on account of the absorption and resistance to the passage of light. The annealing extends over a period of 10 to 15 days, so as to relieve any stress. The glass is allowed to cool gradually in the melting pot, which is then broken away from the glass. When cold, the glass is cleaved into lumps; each lump is carefully examined for any defects, and the best pieces selected for re-annealing; these are then ground to the desired shape for lens or prism. Probably out of one pot only one-fifth would be suitable for use. In preparing the " batch " only the purest materials are used, and those which do not differ greatly in specific gravity. They must be very finely ground, and intimately mixed. The melting pots must be made of the purest and most refractory fire clay in order to prevent any impurities being dissolved into the glass while it is melting. In heating care has to be taken that the pots are heated evenly in every part so that all parts of the glass shall be evenly and completely melted. The glass has to be repeatedly stirred, so as to make the composition of the glass as uniform as possible.

The method of examining "optical glass" depends on the principle that a beam of parallel light passing through a plate of glass will meet with no disturbance so long as the glass is homogeneous, but if striæ are present they will cause the light to deviate wherever it falls upon them. Under such illumination, the striæ will appear as either dark or bright lines.

Chemical stability and hardness are required in optical glass; (1) the best lenses would soon become useless if the action of atmospheric moisture were to affect them appreciably, as they would soon become dulled and useless; (2) lenses and prisms are frequently handled and cleaned, but any minute particle of organic matter, or dust, may affect the polished surface, unless the glass be hard and of fine quality.

A yield of 10 per cent., or at most 20 per cent., of the total contents of the pot is all that can be expected, which accounts for the high price of optical glass. The cost of optical glass varies greatly with the size of the discs required. Thus, while it is possible to obtain 100lbs. of good glass from a single melting, if the glass is to be used in the form of pieces from 1lb. to 6lbs. each, it is rarely that a single block of glass can be found weighing 100lbs.; one single vein or stria invisible to the naked eye may spoil such a piece and render it useless.

Before the war the optical glass trade was confined to a very few firms in this country, and we were dependent on Continental supplies. It is only quite recently that State assistance has come to the aid of our manufacturers by investigating and re-organising the glass industry.

Tubing Glass is made into tubes of all kinds, from the fine capillary tubes used in thermometers to the heavy drawn or pressed tubes used for drainage and other purposes. The usual method is to "gather" a suitable quantity of melted glass on a pipe, blow a small space in it, and elongate the gathering by swinging it in a special manner. The end of the elongated gathering furthest from the pipe is then attached to a rod or "pontil" held by a second workman, and the two men move apart, drawing out the gathering between them; the speed at which they move varies with the bore and thickness of the tube required. For the finest tubes the men move at a smart trot, as the glass cools rapidly; for large, heavy tubes they move very slowly and gradually. The tubes are placed in suitable troughs, and taken to the annealing room, and afterwards cut to the required lengths. Solid glass rods are made by "gathering" without the blow-pipe and are made in the same manner as the tubes.

Artificial Gems are made of a very dense flint glass whose high refractive index facilitates the imitation. These imitations are revealed by their comparative softness, as they are readily scratched by the real minerals; they will not scratch glass; their specific gravity is high, being 4 compared with 1.7 to 2.2 in the real thing. An expert can usually distinguish the genuine from the imitation by the colour.

The great mirrors and lenses of lighthouses and searchlights are made in large iron moulds, and then annealed, and ground and polished. As their use is merely to impart a desired direction to a great beam of light, they are not required to be of such a special quality as telescope lenses, and can easily be made up to large sizes, such as 7 feet in diameter.

Plate-glass is used for making mirrors, which are frequently bevelled nowadays. A thoroughly cleaned plate of polished glass has one surface floated on a solution of nitrate of silver, to which a reducing agent, such as glucose, is added. The silver is thereby precipitated in a fine lustrous film upon the glass, from which rays of light are reflected. After silvering, the back of the plate is coated with a protecting paint or varnish, which dries and preserves the deposit of silver. Messrs. Pilkington, of St. Helens, coat the silver of their mirrors with an electrolytic deposit of copper.

Iridescent Glass is made by adding a small proportion of silver and bismuth to a coloured glass batch; and by manipulating the resulting glass in a carbonaceous or smoky flame, the silver is partially reduced within the glass, forming a pretty iridescent reflexion.

Such is a brief account of a wonderful substance which has contributed so much to the comfort of mankind, to the beauty of his buildings, and to the amenities of his home, and without which science could never have made its wonderful discoveries. Glass may safely be called one of the greatest inventions of man.

Obituary Notices.

Mr. J. H. Ralph Smythe, J.P.

The year has taken heavy toll of the Council, and among those we have lost none will be more acutely missed from the business point of view than Mr. Ralph Smythe. As Chairman of the Council for 5 years he conducted every meeting with a firm hand and a clear head, brushing aside irrelevancies and going straight to the point with unfailing acumen and cheerful tact. For this his legal training was probably responsible; in earlier years he had been a practising solicitor, and his sound legal knowledge was a great asset to the local Bench to which he was appointed a quarter of a century ago. He served the Borough as Councillor and Alderman and was always keenly interested in Municipal affairs. " Naturally of a cautious temperament, he yet could give earnest support to new movements," among which the Boy Scouts enlisted his ardent support as Secretary of the Hampshire Association, and maintained it to the end. " Those who have known Bournemouth for a length of years will deplore the loss of a citizen respected both for his personal rectitude and his public service."

Mr. William Dieselhorst. A.M.I.C.E.

To many of us who knew Mr. Dieselhorst well as a member of the Society he appeared, perhaps, to be just a keen photographer, and a delightfully genial and enthusiastic Chairman of the Section. As such he had done duty for 5 years and had revolutionised the Dark Room, making it for the first time a practical work-shop, and equipping it with perfectly adjusted apparatus. His Lectures had shown us that his own accomplished work was no matter of chance, but was based upon technical and scientific foundations of microscopic accuracy. But few of us were aware that in his former sphere he had been a very considerable figure in the world of Electrical Engineering. And all who knew him here will be glad to gather a clearer estimate of his capacity and character from the following details kindly supplied by Messrs. Siemens from their employés' journal.

Having joined the Company in 1874 he sailed as assistant engineer in the " Faraday " on her maiden voyage to lay the first Atlantic Cable for the Direct United States Cable Company, the first Atlantic Cable made and laid by Siemens Brothers.

From that time onward he accompanied various cable-laying expeditions; notably for the two Western Union Atlantic cables of 1881 and 1882, and the Mackay Bennett Atlantic cables of 1884 and 1885.

Mr. Dieselhorst was very resourceful and ingenious. He designed an appliance known as the " wire stopper," to replace the heavy chains previously used for securing a grip on a cable, which is now universally employed in deep sea cable repair work. He also developed a method of insulating and armouring inductance coils for insertion in guttapercha submarine telephone cables; the first cable of this description was laid under his supervision between Cape Gris Nez and Abbot's Cliff. In the domain of underground cables he did a great deal of pioneer work; he was the joint inventor of the multiple twin type of telephone cable known as the Dieselhorst-Martin, which has been adopted throughout the world as a standard form of trunk telephone cable.

In 1889 he was appointed manager of the Cable Works, and in 1909 General Manager of the Woolwich Works, a post from which he retired in 1915. By reason of his great experience he was recognised all over the world as a leading authority in cable matters and as one whose advice was sought by the engineers of many governments and administrations.

Colonel James Richard Dodd, M.D., F.R.C.S.

Colonel Dodd had a distinguished career in the Army Medical Service, serving in the Far East, and in the Ashanti Campaign, where he was awarded the Bronze Star. From a special mission to the West Indies, where he had been sent to investigate disease among the natives, he was recalled for active service in the Great War. On retirement he developed an interest in Archaeology, and for two years held the post of Chairman of the Archaeological Section. He made a special study of the Roman Wall, and on this and kindred subjects he was an effective lecturer and speaker. He was a genial and enthusiastic leader of excursions, and served for several years as our Delegate to the Congress of the South Eastern Union of Scientific Societies. His intense patriotism found vent in the activities of the National Citizens' Union. He was for some years Chairman of his local branch, and strove hard to stem the rising tide of municipal extravagance. He was a very keen angler and an excellent shot. As a sportsman he had contributed various articles to periodicals, and his name will be found in the Encyclopaedia Britannica.

Dr. Jamieson Boyd Hurry, M.A., M.D.

On his retirement from active work Dr. Hurry came to us from Reading, where he had established a remarkable reputation as author, antiquary and public benefactor. His best known works at home, and in translations in many foreign countries, are " Vicious Circles in Disease " and " Poverty and its Vicious Circles." To this must be added his later monograph on " Imhotep, the Egyptian Deity of Medicine," the fruit of years of study, a combination of expert knowledge of medicine and history unique in the annals of Egyptology. Reading Abbey had been his peculiar care. He had compiled an exhaustive history of it, and had enriched the town with a fine memorial to its founder Henry I, and with a series of ten large paintings depicting various episodes in the history of the Abbey and Borough. To the University College he presented its gymnasium, and he was largely instrumental in the development of a scheme for establishing Public Libraries.

To us he was best known as a unique botanist, and as such he filled an important niche in the Council. His magnificent collection of tropical and Economic Plants, foods, fibres, dyes and medicaments, he transported from his old home and presented to the Borough; they are installed in the King's Park Nurseries. A similar collection, on a smaller scale, he gave to our Society. In his latest days the subject of woad had attracted his close attention. He had collected all available information, and had practically completed a book on the subject, the publication of which will be awaited with interest by antiquarians and botanists.

Historical Lists of Officers of the Society.

Compiled by the late Mr. R. A. de Paiva.

Presidents

1903-4	J. E. Beale (Mayor of Bournemouth).
1904-5—1905-6	G. E. J. Crallan, M.A., M.B., M.R.C.S.
1906-7	H. J. Waddington, F.L.S.
1907-8—1908-9	A. Ransome, M.A., M.D., F.R.C.P., F.R.S.
1909-10	Dr. A. Smith Woodward, F.R.S., F.L.S., F.G.S.
1910-11	Dr. Dukinfield H. Scott, M.A., LL.D., F.R.S., F.L.S., F.G.S.
1911-12 — 1912-13	Sir E. Ray Lankester, K.C.B., M.A., LL.D., F.R.S., F.L.S.
1913-14 — 1914-15 —1915-16	Sir Daniel Morris, K.C.M.G., J.P., M.A., D.SC., D.C.L., F.L.S.
1916-17	The Rt. Hon. the Earl of Malmesbury, D.L., J.P.
1917-18	Sir Jethro J. H. Teall, M.A., D.SC., LL.D., F.R.S.
1918-19 — 1919-20	Field Marshall Lord Grenfell of Kilvey, G.C.B., G.C.M.G., LL.D., F.S.A.
1920-21	Lt.-Col. Sir David Prain, C.M.G., C.I.E., F.R.S.
1921-22 — 1922-23	F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.
1923-24	Sir F. W. Keeble, K.B.E., D.SC., F.R.S.
1924-25 — 1925-26	Hubert Painter, B.SC., F.C.S.
1926-27 — 1927-28	Heywood Sumner, F.S.A.
1928-29	Claude Lyon.
1929-30	Professor F. O. Bower, D.SC., F.R.S.
1930-31	Henry Bury, M.A., F.L.S., F.G.S.

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1916-30	H. Backhouse, F.R.H.S.
1905-14	G. Brownen, F.C.S.
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1921-25	Field Marshall Lord Grenfell of Kilvey, G.C.B., G.C.M.G., LL.D., F.S.A.
1904	E. Hyla Greves, M.D., M.R.C.P.
1914-16	G. G. Hamilton, F.R.C.S., F.R.H.S.
1910-12	C. J. Hankinson, J.P.
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1905-20	J. E. Liddiard, F.R.G.S.
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1916-	Sir Daniel Morris, K.C.M.G., J.P., M.A., D.SC., D.C.L., F.L.S.
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1916-24—1926	Hubert Painter, B.SC., F.C.S.
1916-21—1923-	F. G. Penrose, M.A., M.D., F.R.C.P., F.Z.S., M.B.O.U.
1909-21	A. Ransome, M.A., M.D., F.R.C.P., F.R.S.
1907-18	Miss C. Agnes Rooper
1904-8	W. Saville-Kent, F.L.S., F.Z.S., F.R.M.S.
1916-	R. Vowell Sherring, F.L.S.
1918-25	Rev. H. Shaen Solly, M.A.
1905-11	A. W. Thomas, M.D.
1905-16	J. Roberts Thomson, M.D., F.R.C.P., J.P.
1905-6 — 1907-14	H. J. Waddington, F.L.S.
1928-	Rev. C. O. S. Hatton, B.A., F.L.S.
1928-	Heywood Sumner, F.S.A.
1928-30	Henry Bury, M.A., F.L.S., F.G.S.
1929	J. H. Ralph Smythe, J.P.

Chairmen of Committee

1904-5	J. Roberts Thomson, M.D., F.R.C.P., J.P.
1905-6	J. E. Liddiard, F.R.G.S.
1906-7	H. J. Waddington, F.L.S.
1907-10	W. T. Ord, F.G.S.

Chairmen of Council

1910-11	W. T. Ord, F.G.S.
1911-14	Sir Daniel Morris, K.C.M.G., J.P., M.A., D.SC., D.C.L., F.L.S.
1914-Dec. 15	G. G. Hamilton, M.A., F.R.C.S.
1916-17	Sir Daniel Morris, K.C.M.G., J.P., M.A., D.SC., D.C.L., F.L.S.
1917-Feb. 19	W. Munn Rankin, M.SC., B.SC.
1919-Mar. 20	Sir Daniel Morris, K.C.M.G., J.P., M.A., D.SC., D.C.L., F.L.S.
1920-22	Hubert Painter, B.SC, F.C.S.
1922-27	J. H. Ralph Smythe, J.P.
1927-	Rev. C. O. S. Hatton, B.A., F.L.S.

Deputy Chairmen of Council

1911-14	G. G. Hamilton, M.A., F.R.C.S.
1914-Feb. 16	Henry Backhouse, F.R.H.S.
1916 Mar.-Nov. 16	R. O'B. Furlong, C.B., J.P., M.A.
1916 Dec.-17	W. Munn Rankin, M.SC., B.SC.
1917-19	F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.
1919-20	Hubert Painter, B.SC., F.C.S.
1920-22	J. H. Ralph Smythe, J.P.
1922-27	Rev. C. O. S. Hatton, B.A., F.L.S.
1927-28	J. H. Ralph Smythe, J.P.
1928	Claude Lyon
1929-	F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.

Hon. Treasurers

1904-8	A. D. George.
1908-	G. Brumell, A.R.I.B.A.

Hon. Secretaries

1904-7	Miss C. Agnes Rooper and J. R. L. Dixon, M.R.C.S., L.R.C.P.
1907-8	J. R. L. Dixon, M.R.C.S., L.R.C.P., and H. Backhouse, F.R.H.S.
1908-10	J. R. L. Dixon, M.R.C.S., L.R.C.P., and Col. E. E. Markwick, C.B., C.B.E., F.R.A.S.
1910 Sept.-Oct.	J. Donkin, F.R.I.B.A.
1910-11	H. Le Jeune.
1911 Nov.- Feb. 1912	Sir A. Brooke Pechell, BART., M.B.
1912 Apr.- Mar. 1914	T. Michell, M.I.C.E.
1914 Apr.-Oct.	R. A. de Paiva.
1914 Oct.- July 1917	R. A. de Paiva and T. Capper, M.A., B.SC.,
1917 July-25	R. A. de Paiva.
1925-26	R. A. de Paiva and Rev. A. G. Yates, M.A., R.N.,
1926-	Rev. A. G. Yates, M.A., R.N.

Hon. Assistant Secretaries

Apr. 1911-1912	T. Michell, M.I.C.E.
May Mar. 1912-1914	R. A. de Paiva.
1917-1918	G. G. Grace, B.SC., A.R.C.SC., F.E.S.
1919-1920	W. G. Boul, M.A., LL.D., D.C.L.
1920-	W. J. Woodhouse, A.C.P., M.I.H.

Hon. Financial Secretary

1905-8	J. H. Scott, M.E., M.I.M.C.E.

Assistant Secretary

1909-	J. F. Spencer.

Hon. Librarians

1908-1909 ...	A. Scott, B.A.
1909-1911 ...	F. I. Cooke.
1911-1912 ...	W. Munn Rankin, M.Sc., B.Sc.
1913-1919 ...	H. J. Ellis.
1919 Oct.- Mar. 1926	J. Omer Cooper, F.E.S.
1920 Mar.- Jan. 1921	Rev. C. O. S. Hatton, B.A., F.L.S.
1921 Jan.- ...	Claude Lyon.
1923-1929 ...	Miss A. G. Veale, Hon. Assistant Librarian.
1929-	S. Whitaker, Hon. Assistant Librarian.

Hon. Editors

1911-12	G. E. J. Crallan, M.A., M.B., M.R.C.S.
1912-20	Hubert Painter, B.Sc., F.C.S.
1920-25	F. B. Taylor, B.A.
1925-	J. R. White, M.A.

Hon. Curators

1917 Jan.- July 1921	W. G. Wallace.
1921-Dec. 1922 ...	No Curator.
1923 Jan.-Nov. ...	Rev. C. O. S. Hatton, B.A., F.L.S., and Howard Lacey, B.A.
1923 Dec.- ...	Rev. C. O. S. Hatton, B.A., F.L.S.

Chairmen of Sections.

Antiquarian

1904-7	A. W. Thomas, M.D., M.R.C.S.

Archæological and Historical

1907-8	A. W. Thomas, M.D., M.R.C.S.
1908-Feb. 14 ...	G. Brownen, F.C.S.
1914 May-Nov. ...	Rev. Canon T. E. Usherwood, M.A.
1914 Dec.-24 ...	Rev. H. Shaen Solly, M.A.
1924-26	Col. J. R. Dodd, M.D., F.R.C.S.
1926-	R. K. Cardew, B.A.

Deputy Chairmen

1922-24	Col. J. R. Dodd, M.D., F.R.C.S.
1925-26	R. K. Cardew, B.A.

Astronomical

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1925-26	G. E. J. Crallan, M.A., M.B., M.R.C.S.
1928-29	L. B. Benny, M.A., B.Sc., F.R.A.S.
1929-	J. A. Formoy, F.R.A.S.

Deputy-Chairman

1927-28	L. B. Benny, M.A., B.Sc., F.R.A.S.

Mathematical

1921-22	W. H. Scott, M.A
1922-24	B. M. Peek, M.A., F.R.A.S.

Astronomical and Mathematical

1924-25	B. M. Peek, M.A., F.R.A.S.

Botanical

1904-5	Rev. E. F. Linton, M.A., F.L.S.
1905-7	J. F. Rayner, F.R.H.S.
1907-May 18 ...	Miss C. Agnes Rooper.
1918-22	Rev. C. O. S. Hatton, B.A., F.L.S.
1922-26	Howard Lacey, B.A.
1926-27	Rev. C. O. S. Hatton, B.A., F.L.S.
1927-	L. Beeching Hall, F.L.S.

Entomological

1914-15	R. Beck, F.E.S.
1915-Dec. 19	F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.
1920-Jan. 26	J. Neale, B.A.
1926-29	Howard Lacey, B.A.
1929-	Alan Druitt, F.E.S.

Geographical

1908-10	J. E. Liddiard, F.R.G.S.
1910-11	A. Scott, B.A.
1911-16	G. de Castro, M.R.C.S.
1916-	Claude Lyon.

Geological

1904-5	Rev. G. D. Shenton, B.A.
1905-6	The Marquis de Trevelec.
1906-14	W. T. Ord, F.G.S.
1914-17	W. Munn Rankin, M.SC., B.SC.
1917-18	H. Kidner, F.G.S.
1918-20	W. Munn Rankin, M.SC., B.SC.
1920-23	W. J. Woodhouse, A.C.P., M.I.H.
1923-	Henry Bury, M.A., F.L.S., F.G.S.

Photographic

1905-8	Councillor R. Y. Banks.
1908-10	C J. Hankinson, J.P.
1910-12	E. W. Barlow, F.R.A.S.
1912-13	G. Brumell, A.R.I.B.A.
1913-14	No Chairman.
1914-16	R. Y. Banks.

Photographic and Record

1916-25	R. Y. Banks.
1925-30	W. Dieselhorst, A.M.I.C.E.
1930-	S. Whitaker.

Physical

1904-26	Hubert Painter, B.SC., F.C.S.
1928-29	G. E. J. Crallan, M.A., M.B., M.R.C.S.
1929-	Miss Marcia Penrose, B.SC.

Deputy Chairman

1926-28	G. E. J. Crallan, M.A., M.B., M.R.C.S.

Zoological

1904-8	G. E. J. Crallan, M.A., M.B., M.R.C.S.
1908-10	A. W. Thomas, M.D., M.R.C.S.
1913-14	W. Munn Rankin, M.SC., B.SC.
1922–	F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.

Microscopical

1909 Mar.-10	J. R. L. Dixon, M.R.C.S., L.R.C.P.
1913-14	H. B. Wells, F.R.M.S.
1922-30	F. B. Taylor, B.A.
1930	F. W. Parrot.

Zoological and Microscopical

1910-11	H. B. Wells, F.R.M.S. A. W. Thomas, M.D., M.R.C.S.
1911 Mar.-12	G. E. J. Crallan, M.A., M.B., M.R.C.S.
1911-13	H. B. Wells, F.R.M.S.
1914-16	T. B. Goodall, F.R.C.V.S., F.L.S.
1916-22	F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.

Elected and co-opted Members of Council.

Title changed from Committee in 1910.

Many of these also had seats on the Council ex-officio either before or after their election or co-option. Their names are marked*

1905-7	Atkins, Dr. F.
1906-7—1908-30	*Backhouse, H., F.R.H.S.
1914-15	*Banks, R. Y.
1905-6	Bax, P. B. Ironside.
1904	Bond, Dr. Eleanor.
1919-20	Boul, Mrs.
1904-8	*Brownen, G., F.C.S.
1906-8	*Brumell, G., A.R.I.B.A.
1906-8	Buckland, Dr. Frank.
1930	Burton, E. St. John, F.L.S., F.G.S., F.Z.S.
1921-22	*Cardew, R. K., B.A.
1909-11	Chandler, S. Whitty, B.A.
1905-6	Clements, Lt.-Col. W. G.
1904	Clift, Dr.
1921-28	Curme, Mrs.
1905-10	Curtis, W. Parkinson, F.E.S
1923-26—1927-30	*Dodd, Col. J. R., M.D., F.R.C.S.
1914-16	Druitt, J., J.P.
1916-17	Dyer, J. Herbert.
1919-25	*Ellis, H. J.
1910-30	French, J. M.
1929-	Fryer, Miss C. H.
1914-17	Furlong, R. O'B., C.B., M.A.
1919-Aug. 21	*George, A. D.
1904	Giles, Dr.
1904-6	*Goodall, T. B., F.R.C.V.S., F.L.S.
1918-20	Gosse, W., M.D., D.P.H.
1921-23	Gray, Arthur.
1910-15	Hamilton, G. G., M.B., F.R.C.S.
1916-18 — 1922-23	Hatton, Rev. C. O. S., B.A., F.L.S.
1911-16	Hill, S. McCalmont, D.C.L.
1926-30	Hurry, J. B., M.A., M.D.
1916-19	Jeffery, T. J. P.
1906-10 — 1911-18	*Le Jeune, H.
1926-	Longbottom, F. W., F.R.A.S.
1914-16	*Lyon, Claude.
1907-8	*Markwick, Col. E. E., C.B., C.B.E., F.R.A.S.
1907-8	Maude, W. C., J.P.
1910-16	*Morris, Sir Daniel, K.C.M.G., J.P., M.A., D.SC., LL.D., F.L.S.
1910-11	*Michell, T., M.I.C.E.
1916-19	*Neale, Joseph, B.A.
1905-6	*Ord, W. T., F.G.S.
1904	Parish, Miss
1915-16	*Penrose, F. G., M.D., F.R.C.P., F.Z.S., M.B.O.U.
1917-18	*Rankin, W. Munn, M.SC., B.SC.
1904	Reid, C. J.
1919-	Rooke, Miss S. G.
1918-19	Rothwell, Mrs.
1908-9	Scott, A., B.A.
1908-	*Scott, J. H., M.E., M.I.M.C.E
1904-26	Sherring, R. Vowell, F.L.S.
1920-27	Simpson, Rev. E. J. Douglas, M.A.
1916-29	Smythe, J. H. Ralph, J.P.
1923-	*Spencer, J. F.
1905-10	Stubbs, G. M.
1918-20	*Taylor, F. B., B.A.
1921-23	*Wallace, W. G.
1907-10	*Wells, H. B., F.R.M.S.
1930	*Whitaker, S.
1906-7 — 1916-20 1923-	*Woodhouse, W. J., A.C.P., M.I.H.

Various Committees

Chairman: Rev. C. O. S. Hatton, B.A., F.L.S.

1915 Dec.-Oct. 1919	General Policy of the Society.
1919 Nov.-Feb. 1920	Housing.
1920 Feb.-Oct. 1922	Housing and Finance
1922-	Finance and General Purposes.

Library Committee

Chairmen

1918 Mar.-Oct. 1918	G. G. Grace, B.SC., A.R.C.SC., F.E.S.
1918 Nov.-Oct. 1919	Hubert Painter, B.SC., F.C.S.
1919 Nov.-	Rev. C. O. S. Hatton, B.A., F.L.S.

Museum Committee

Chairmen

1917-1921	W. G. Wallace.
1921-	Rev. C. O. S. Hatton, B.A., F.L.S.

Hon. Auditors.

1906-9	H. Sutton and K. H. Mundell.
1909-14	H. Sutton and E. Bicker.
1914-15	E. Bicker and H. Backhouse, F.R.H.S.
1915-17	E. Bicker and E. W. Barlow, F.R.A.S.
1917-28	E. Bicker and C. H. Blackett.
1928-	E. Bicker and Son, and F. Broad.

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The Hon. Secretary (Rev. A. G. Yates, M.A., R.N.)
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Claude Lyon.

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G. E. J. Crallan, M.A., M.B., M.R.C.S.
Claude Lyon (Hon. Librarian)
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S. Whitaker

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Chairman of Botanical Section (L. Beeching Hall, F.L.S.)
Chairman of Entomological Section (Alan Druitt, F.E.S.)
Chairman of Geological Section (Henry Bury, M.A., F.L.S., F.G.S.)
Chairman of Zoological Section (F. G. Penrose, M.D., F.R.C.P., F.Z.S., M.B.O.U.)
G. E. J. Crallan, M.A., M.B., M.R.C.S.
E. St. J. Burton, F.L.S., F.G.S., F.Z.S.

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G. E. J. Crallan, M.A., M.B., M.R.C.S.
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(Chairman)
Chairman of Botanical Section
(L. Beeching Hall, F.L.S.)
Miss S. G. Rooke.
Miss S. Wetherell
H. J. Wadlow
Miss Fryer

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NATURAL
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